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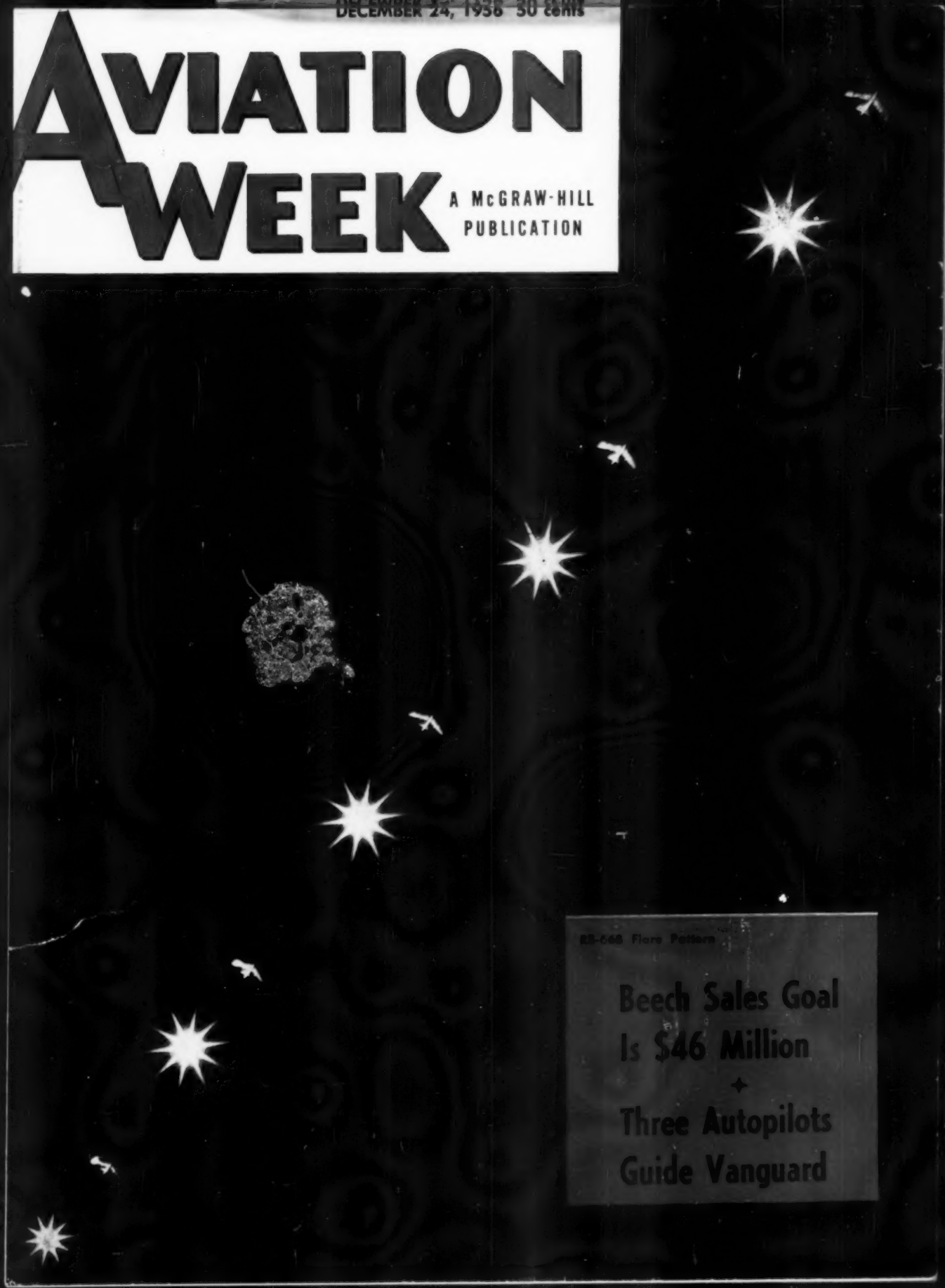


XB-668 Flare Pattern

Beech Sales Goal Is $46 Million

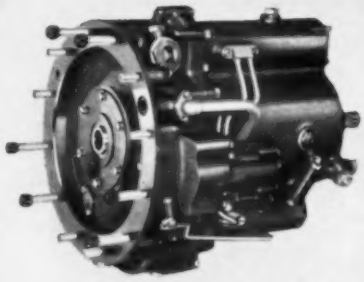
✦

Three Autopilots Guide Vanguard

First in Constant Speed Drives . . .

SUNDSTRAND

Package-type



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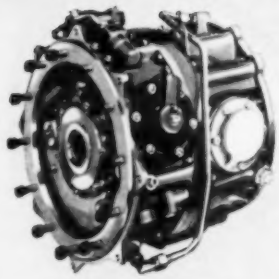
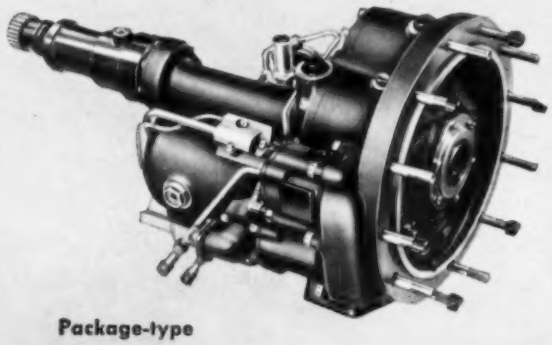


Radial-type



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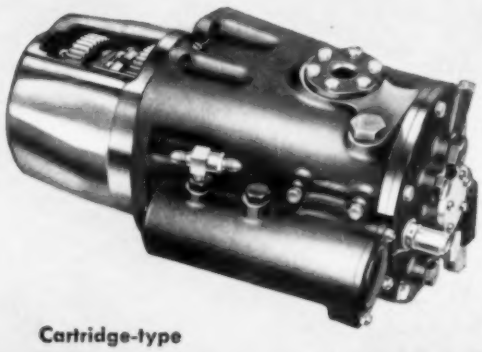

Cartridge-type

Millions of flight hours logged by over 10,000 units

Here is unequaled experience! More than 20 models of Sundstrand Constant Speed Drives for aircraft electrical systems have been designed, built, and installed on virtually every major type of aircraft. That's the record for the last 10 years. Total installations passed the 10,000 mark some time ago.

What's behind these records? Two factors stand out: Proved reliability and unexcelled performance. The millions of flying hours logged by the many models used in reciprocating, turbojet, and turboprop engines attest to the reliability. Custom design of each installation insures top performance.

To these facts add the assurance of prompt and thorough service from Sundstrand representatives located throughout the free world, and you will see why Sundstrand Constant Speed Drives are being used on so many first-line military aircraft today. You'll see, too, why so many of tomorrow's exciting new aircraft—including the new jet airliners—are specifying Sundstrand.

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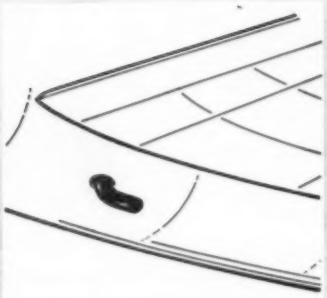
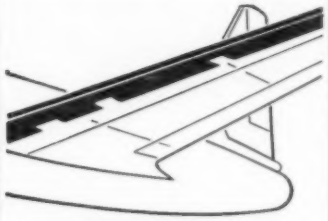
Here is *fully proved*, foolproof ice protection for aircraft—for propellers, wings, empennage—for air scoops, antennas, pipe and conduit—for any surface—any size, any shape.



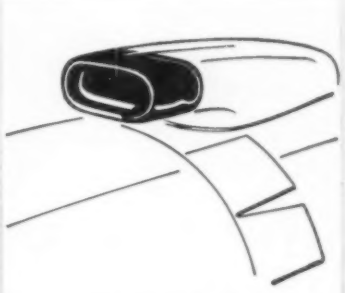
YOUR PROBLEM SMALL?

Here, for relief tubes, is an Iceguard 2⅝ inches small—made of *electrically conductive rubber.*



YOUR PROBLEM BIG?

Here, for a wing leading edge, is an Iceguard — made of resistance wire and divider strip heaters molded into a special erosion-resistant rubber. Iceguard applications of this type *have been built* by Goodyear *up to 17 feet in length.*



YOUR PROBLEM SHAPE?

Here, specially designed for air scoops, is an Iceguard—made of electrically conductive rubber.

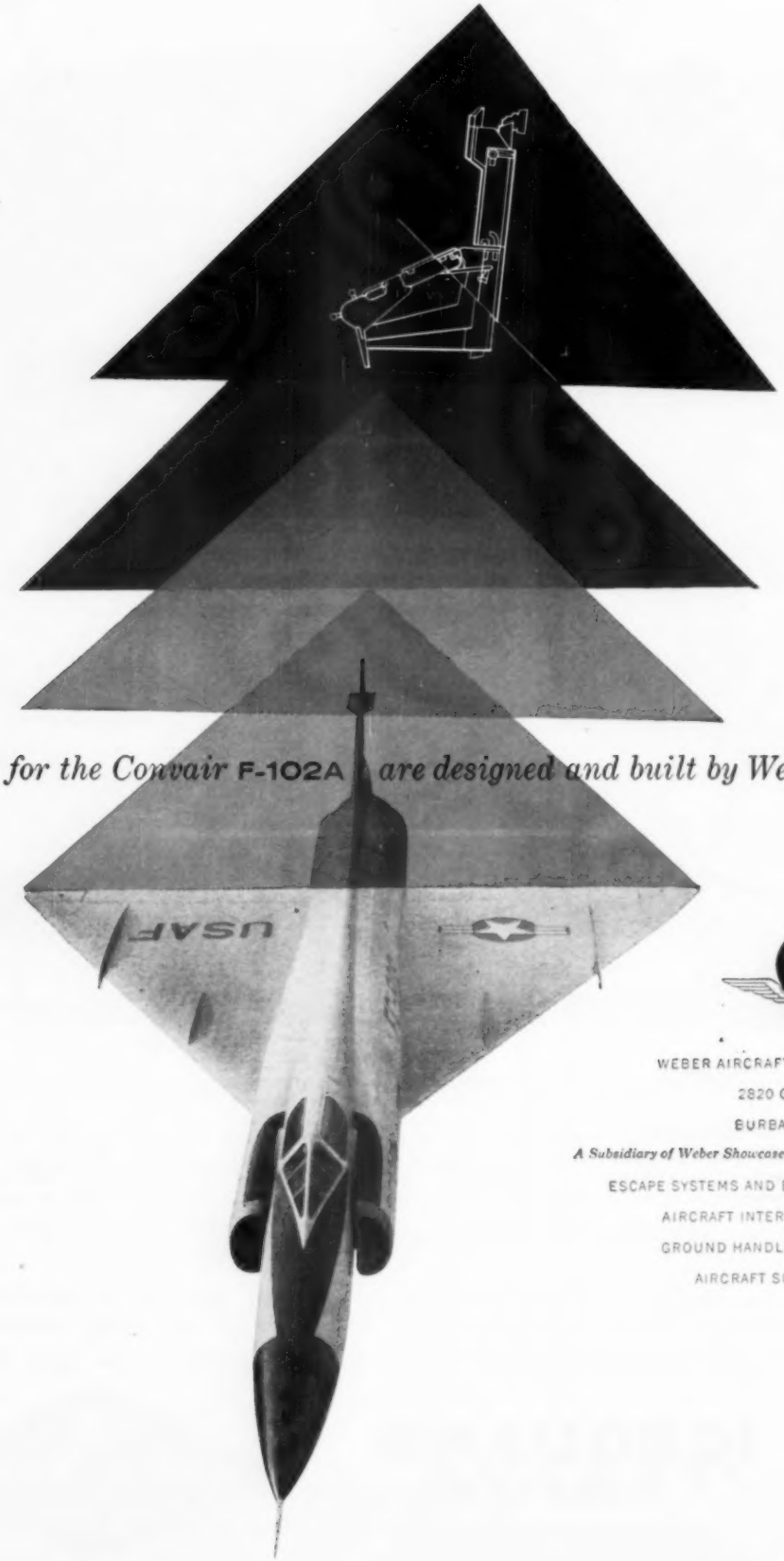
No matter what the size, no matter how complex the contour, no matter how tough the problem—here is fully automatic, electrothermal ice protection with the Iceguard by Goodyear—long a pioneer in aviation.

For details write: Goodyear, Aviation Products Division, Akron 16, Ohio, or Los Angeles 54, California

ICEGUARD

Pioneer Ice Protection by

GOODYEAR AVIATION PRODUCTS



ejection seats for the Convair **F-102A** *are designed and built by Weber*

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AVIATION CALENDAR

Dec. 28-31—Third King Orange International Model Plane Contest, U. S. Marine Corps Air Station, Miami, Fla.

Jan. 8-9, 1957—15th Annual Miami-Havana Air Cruise, sponsored by Florida Air Pilot's Assn. For details write: James G. Page, cruise director, FAPA, 310 S.E. 2d Ave., Miami, Fla.

Jan. 14-16—National Symposium on Reliability and Quality Control in Electronics, sponsored by IRE, ASQC, AIEE and RETMA, Hotel Statler, Washington, D. C.

Jan. 21-22—Symposium on Solar Furnace Design and Operation, Hotel Westward Ho, Phoenix, Ariz.

Jan. 27-28—American Society for Metals, Albuquerque and Los Alamos Chapters, "Heat Tolerant Metals for Aerodynamic Applications," Albuquerque, N. M.

Jan. 28-31—8th Plant Maintenance & Engineering Conference, Public Auditorium, Cleveland, Ohio.

Jan. 28-31—25th Annual Meeting, Institute of the Aeronautical Sciences, Sheraton-Astor Hotel, New York, N. Y. Honors Night Dinner, Jan. 28.

Jan. 31—Sixth Annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif. Additional course will be held Feb. 1.

Feb. 4-8—X-Ray Diffraction School, North American Phillips Co., 750 S. Fulton Ave., Mt. Vernon, N. Y.

Feb. 7—Operations Research Symposium University Museum Lecture Hall, University of Pennsylvania, Philadelphia, Pa.

Feb. 7—Annual Mid-Winter Symposium of the New York Section, Instrument Society of America, Garden City Hotel, Long Island, N. Y.

Feb. 14-15—1957 Transistor and Solid State Circuits Conference, University of Pennsylvania, Philadelphia, Pa.

Feb. 26-28—Western Joint Computer Conference, sponsored by IRE, AIEE and ACM, Hotel Statler, Los Angeles, Calif.

Mar. 7-9—National Conference on Aviation Education, Hotel Mayflower, Washington.

Mar. 11-15—1957 Atomic Exposition, including Nuclear Engineering & Science Congress, 5th Atomic Energy in Industry

AVIATION WEEK • DECEMBER 24, 1956
Vol. 65, No. 26

Published weekly with an additional issue in December by the McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices: 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Paul Montgomery, Executive Vice-President; Joseph A. Gerardi, Executive Vice President and Treasurer; Hugh J. Kelly, Executive Vice President; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publication Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; J. E. Blackburn, Jr., Vice President and Circulation Director.

Subscription: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 West 42nd St., New York 36, N. Y. Allow 10 days for change of address.

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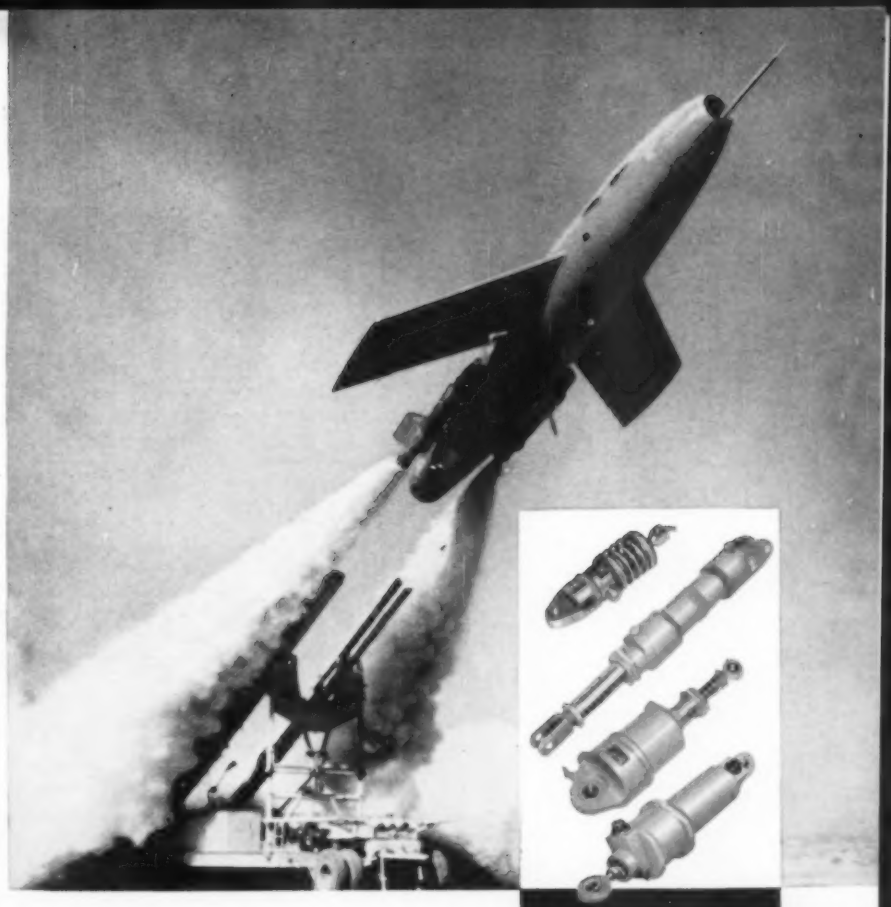

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Globe Aerostatique . . . 1783

Montgolfier's vanguard project

A sheep, a duck, a rooster—the first payload carried aloft for atmospheric research. Louis XVI, his queen and his court, were astonished witnesses as Joseph Montgolfier's smoke-filled balloon rose in majesty 1500 feet over Versailles. The passengers? unharmed (except the rooster, kicked by the sheep).

Project Vanguard, 1957, is an equally momentous "first"—an attempt to place a 21-pound satellite in an orbit 300 miles up. Aerojet-General, designer-builder of the famed Aerobee-Hi, will supply vital second-stage propulsion systems for Vanguard launchings during the International Geophysical Year.

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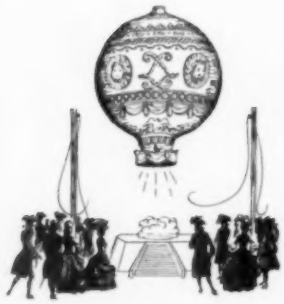

The International Geophysical Year is a period of intensive research devoted to the earth and its surroundings. Aerojet-General research rockets will play a major role in IGY. In addition to Project Vanguard propulsion systems, Aerojet will supply its famed Aerobee-Hi rockets for critical research flights from Hudson Bay.

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Write: Director of Scientific and Engineering Personnel, Box 296N, Azusa, Calif. or Box 1947N, Sacramento, Calif.

Conference and 5th Hot Laboratories & Equipment Conference, Convention Hall, Philadelphia, Pa.

Mar. 14-15—Flight Propulsion Meeting, (Classified), sponsored by IAS, Hotel Carter, Cleveland, Ohio.

Mar. 18-21—Pacific Coast Plastics Exposition, in conjunction with The Society for Plastics Industry National Conference, Shrine Exposition Hall, Los Angeles.

Mar. 18-21—National Convention, Institute of Radio Engineers, New York Coliseum and Hotel Waldorf-Astoria, New York, N. Y.

Mar. 19-21—151st National Meeting of the American Meteorological Society, University of Chicago.

Mar. 25-27—Silver Anniversary Technical Meeting and Convention, American Society of Tool Engineers, Shamrock Hilton Hotel, Houston, Tex.

Mar. 25-29—Western Metal Congress and Exposition, Ambassador Hotel and Pan-Pacific Auditorium, Los Angeles.

Mar. 27-29—Educational Colloquium on Radiation Effects on Materials, sponsored by ONR and Glenn L. Martin Co., Johns-Hopkins University, Baltimore, Md.

Apr. 8-12—Fifth Welding & Allied Industry Exposition, Convention Hall and Hotel Sheraton, Philadelphia, Pa.

Apr. 16-18—Symposium on Nondestructive Tests in the Field of Nuclear Energy, Morrison Hotel, Chicago, Ill.

Apr. 17-20—Eighth Annual Conclave, Arnold Air Society, including aviation equipment display, Hotel New Yorker, New York, N. Y.

Apr. 24-25—Second National Industrial Research Conference, sponsored by Armour Research Foundation, Conrad Hilton Hotel, Chicago, Ill.

Apr. 29-May 3—Seventh National Materials Handling Exposition, Convention Hall, Philadelphia, Pa.

May 1-3—Spring Meeting and Exhibit, Society for Experimental Stress Analysis, Hotel Statler, Boston, Mass.

May 6-8—28th Annual Meeting, Aero Medical Assn., Shirley Savoy Hotel, Denver, Colo.

May 24-June 2—22nd Paris Air Show, Society of French Aircraft Constructors, Le Bourget Airport, Paris.

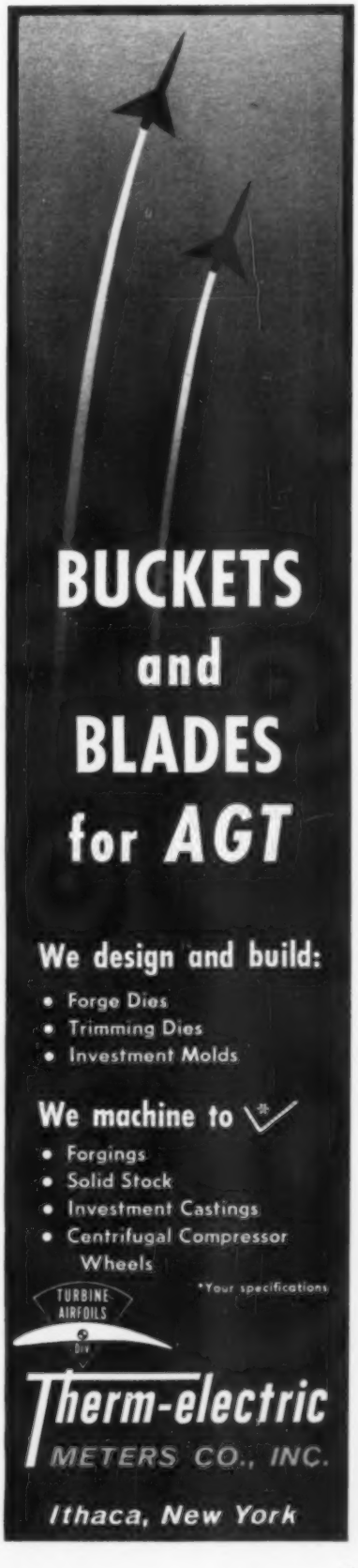
June 1-9—First Annual National Aviation Trade Show, Monmouth County (N. J.) Airport.

June 23-25—29th Annual Meeting, Aviation Distributors & Manufacturers Assn., The Broadmoor, Colorado Springs, Colo.

July 6-10—Eleventh All-Women Transcontinental Air Race, sponsored by Ninety-Nines and Aero Club of Pennsylvania, from San Mateo County Airport, San Carlos, Calif. to N. Philadelphia Airport, Pa. For details write: Headquarters, AWTAR, 2611 E. Spring St., Long Beach 6, Calif.

Aug. 20-23—Western Electronic Show & Convention Board of Directors, Cow Palace, San Francisco, Calif.

Sept. 1-16—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.



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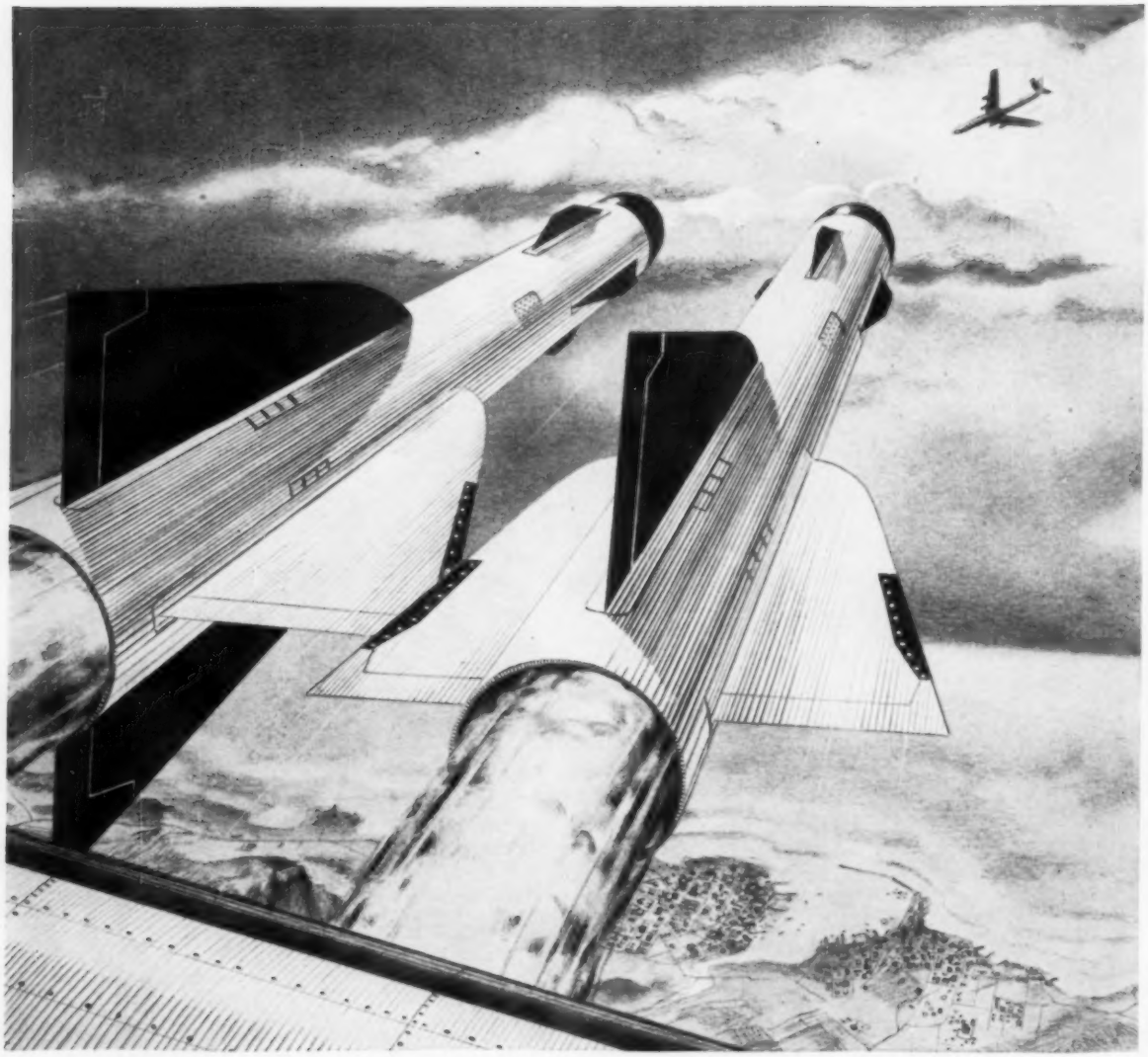

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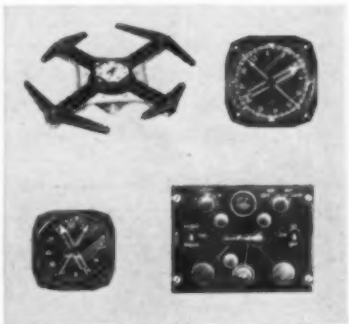

DFA-70 components (clockwise from upper right): MN-72 Radio Magnetic Indicator, CNA-70 Control Panel, MN-58 Dual Azimuth Indicator, LPA-70 Flush Loop Antenna.

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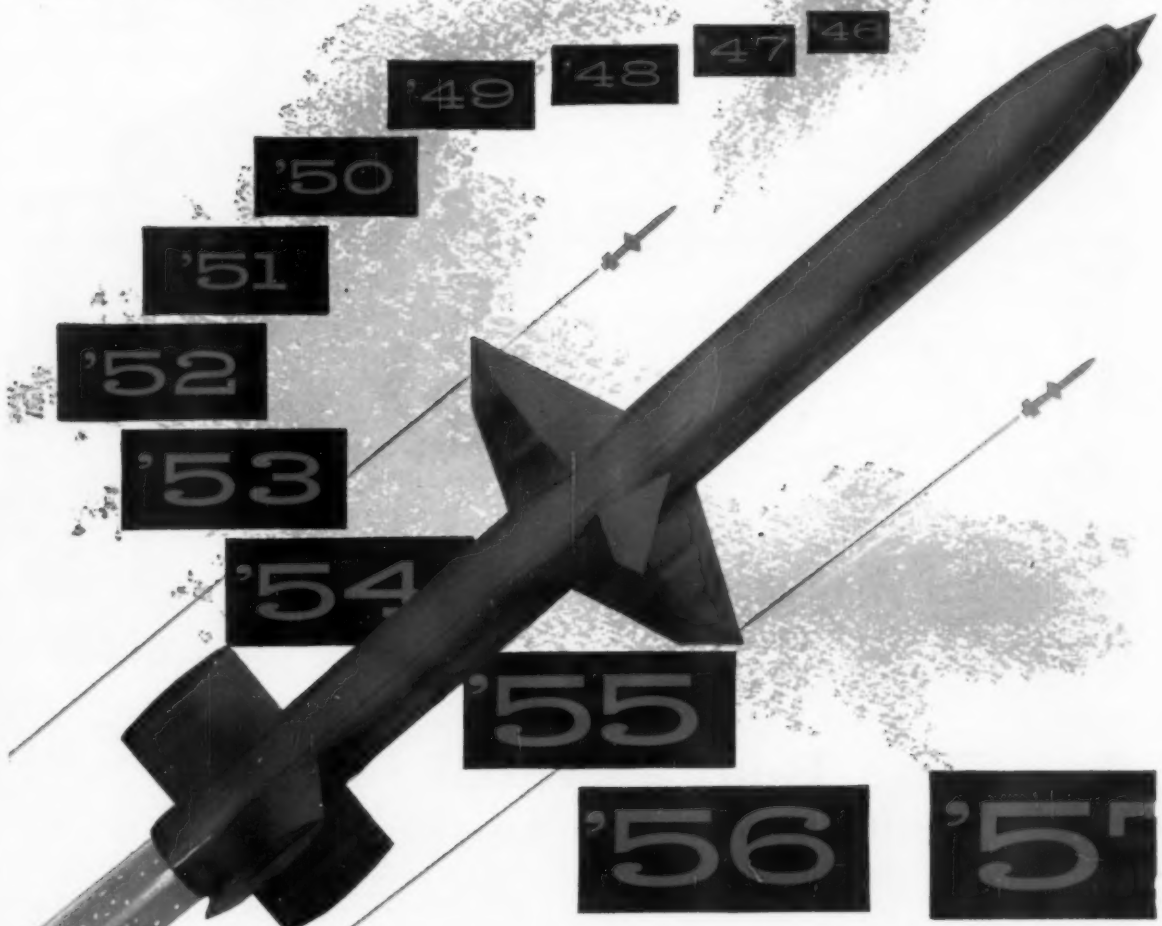

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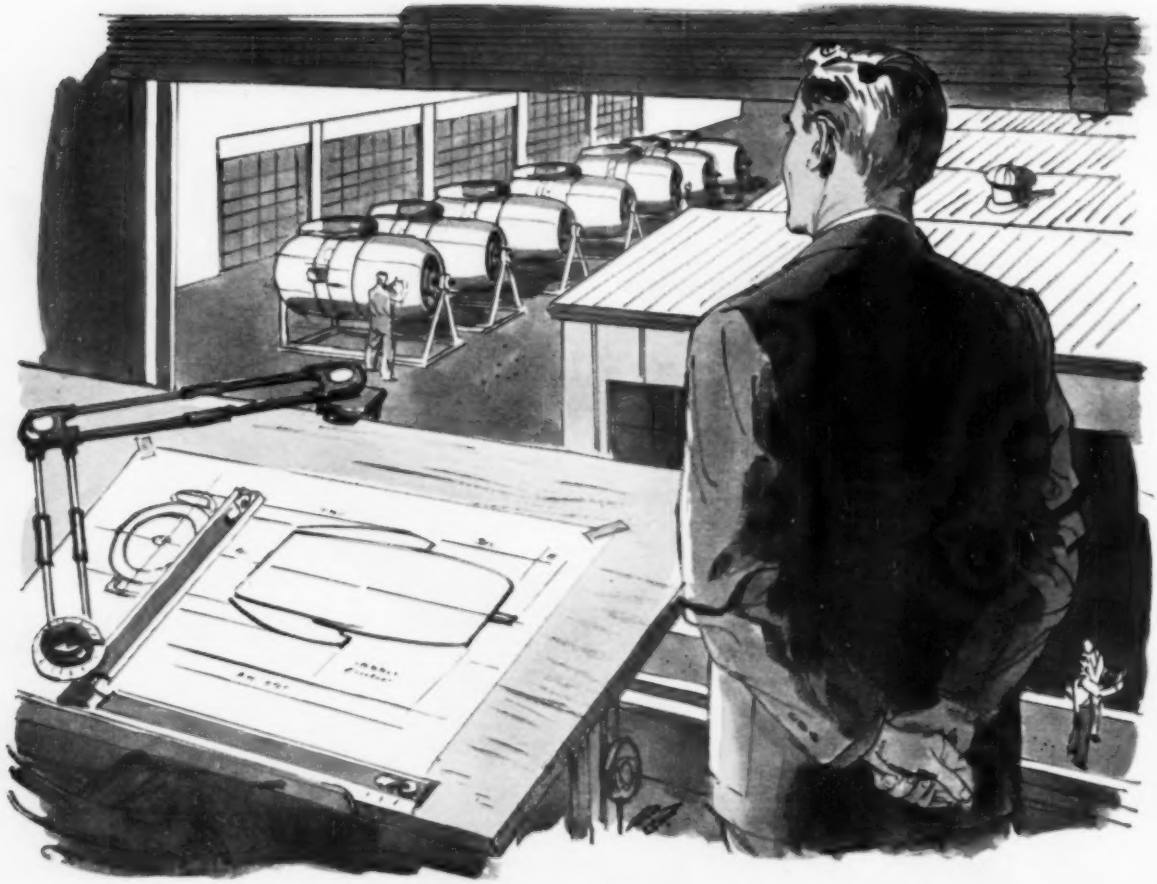

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DECEMBER 24, 1956

AVIATION WEEK

VOL. 65, NO. 26

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Washington 4, D. C.—National Press Bldg., Phones: NAtional 8-3414, REpublic 7-6630
Los Angeles 17—1125 West Sixth St., Phone: MAdison 6-9351

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COVER: Pattern made by flares dropped by an RB-66 on a night reconnaissance test suggests the holiday season. Photograph is a time exposure of a series of flares dropped on a single run. Three different types of photo-flash cartridges and bombs are being tested at the Air Force Operational Test Center, Air Proving Ground Command, Eglin AFB, Fla., where the photograph was made (AW Dec. 10, p. 100).

Picture Credits:
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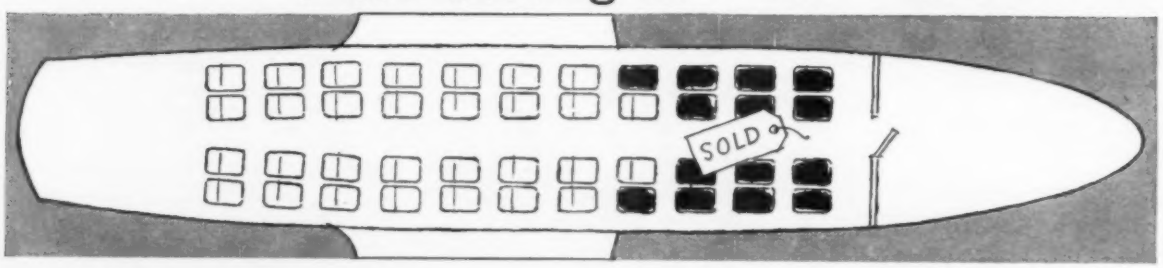
68,177 copies of this issue printed

AVIATION WEEK • DECEMBER 24, 1956 • Vol. 65, No. 26
Member ABP and ABC

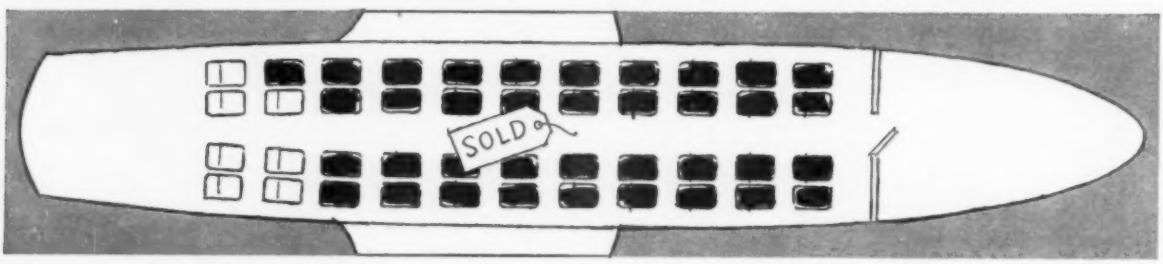
THE ECONOMICAL VICKERS VISCOUNT

How famed turbo-prop aircraft are working for TCA



LOWEST break-even "load factor"

TCA has found the break-even load factor with the turbo-prop Vickers Viscount to be the lowest of any aircraft they use:—29.5%. By selling *14 seats* on each flight, TCA can cover all direct costs of their Viscount operation (excluding overhead)—such as fuel, oil, insurance, flight-crew salaries and expenses, maintenance, labor and material including depreciation.



HIGHEST average "seats sold"

Trans-Canada Air Lines' Viscounts have met with unprecedented passenger approval. As a result, passenger traffic has soared . . . and the average passenger load factor on TCA Viscounts in the first months of 1956 was a remarkable 84% or . . . 37 out of 44 seats sold.

TCA reports the Vickers Viscount is its "most economical aircraft." The combination of this *low* break-even load factor (based on direct costs) and *high* actual "seats sold" average has made the Viscount a resounding success in TCA operation. TCA's experience with the turbo-prop Vickers Viscount is typical of dozens of other airlines throughout the world. *United States Sales Representative: Christopher Clarkson, 10 Rockefeller Plaza, N. Y.*

turbo-prop VICKERS VISCOUNT

POWERED BY FOUR ROLLS-ROYCE DART ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LTD., WEYBRIDGE, ENGLAND • MEMBER COMPANY OF THE VICKERS GROUP

EDITORIAL

Ostrich Heads in the Sand

On page 33 of this issue, we are publishing a picture of part of the crowd of 3,000 people, many of them equipped with cameras, who witnessed the first flight of the Convair XB-58 Hustler supersonic bomber at Ft. Worth, Tex., in October. These people were watching the flight of a large—140,000 lb. gross with 55 ft. wingspan—aircraft from public property adjoining Carswell AFB. This area is open to anybody regardless of nationality or citizenship. At this writing more than two months after this flight, the Defense Department has not yet released photographs of the XB-58.

On page 26 of this issue we report on the performance of two U. S. manufactured interceptors—the Grumman F11F-1F and the Lockheed F-104A—that are capable of recapturing the world speed and altitude records for this country. The general performance brackets of these two fighters are no secret to any one with a type of "ham" radio readily available commercially. Yet the Defense Department is still officially pretending that the general performance characteristics of these fighters are secret.

Several weeks ago, the Defense Department refused for more than 24 hours to confirm the fact that a Northrop Snark guided missile had failed to respond to guidance controls and continued on a 3,000 mile flight until it crashed in Brazil. This Defense Department "no comment" came after the accurate publication of the story by Marvin Miles in the Los Angeles Times and despite the fact that warnings to commercial airliners that the missile was out of control at 40,000 ft. altitude in a specific area were being broadcast through standard airways channels.

All of these incidents are characteristic of the ostrich-like attitude by Department of Defense level public relations officials who complacently bury their heads in the sands while the facts fly by overhead. It is this lack of realism on the part of the highest level of the Defense Department—far above the level of individual military services—that has inspired almost universal contempt for their policies and general disregard of their advice by the working press.

The three examples cited above are just the most recent and most flagrant disregard of reality by Defense Secretary Wilson's public relations staff in their handling of public information from the Pentagon. The Defense Department rulings that tried to prevent this information from reaching the public prints obviously denied nothing to enemy agents interested in these subjects. The only people to whom Mr. Wilson's aides really denied this information was a large portion of the American people who furnish the dollars to pay for their national defense establishment. That this denial was only temporary is due to a flourishing, aggressive press whose members refuse to be impressed by basic stupidity even when cloaked in resounding bureaucratic titles and refuse to be intimidated by threats and bluster even though it emanates from the highest level in the Pentagon.

During the past several years, there have been a variety of governmental groups investigating the alleged "leaks" of military secrets in the public prints. Each group settled on a different scapegoat. Some felt bullying aircraft manufacturers would solve the problem. And the manufacturers are certainly bullied and chivvied ceaselessly by the Pentagon public relations' bureaucrats until even the middle initials of second tier vice-presidents must appear to be top secret. Some felt hauling reporters before grand juries to testify on their sources of information was the answer. Another proposed solution urged retaliation against military officers suspected of telling the taxpayers what is happening to their billions of defense dollars.

With one exception none of the groups have pointed the finger of blame where it really belongs—on the stupid and unrealistic policies of the office of the Secretary of Defense. This exception has been the congressional subcommittee, headed by Rep. John Moss (D.-Calif.), that has been probing into government information policies for some months. The recent testimony of Defense Department public relations officials before the Moss subcommittee strongly reinforces the thesis outlined above that unrealistic stupidity is the first iron curtain that must be dissolved if the American people are ever to truly find out what happens to their billions of defense dollars and whether they are really getting sufficient, efficient defense equipment to truly protect them and their allies in the age of atomic airpower.

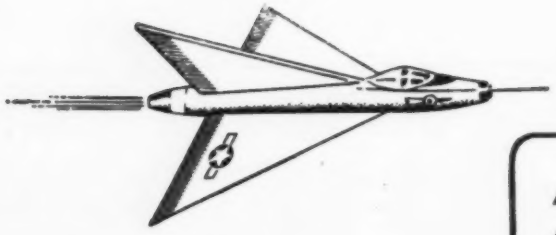
Expansion in Southwest

AVIATION WEEK is establishing a new editorial office in Dallas on Feb. 1 to provide on-the-spot staff coverage of the expanding aviation industry in Texas and the southwestern states. This action continues AVIATION WEEK's policy of editorial expansion tailored to meet the changing needs of the industry it serves and is heartily endorsed by the publisher of this magazine, Robert W. Martin, Jr.

The southwestern editorial office of AVIATION WEEK will be headed by Craig Lewis, now a transport editor in our Washington office specializing in coverage of the Civil Aeronautics Board and the economics of the air transport industry. This office will be located in the McGraw-Hill Publishing Co. quarters at 1020 Adolphus Tower Building on the corner of Main and Ackard Sts., Dallas 2, Texas. Mr. Lewis is a veteran of four and a half years in McGraw-Hill editorial service. He is a graduate of the University of California at Los Angeles and has been with AVIATION WEEK for two and a half years.

Establishment of an AVIATION WEEK editorial office in the Dallas-Ft. Worth area is recognition of the growing importance of Texas and the Southwest to the future of aviation. With such great firms as Chance Vought, Temco, Convair, Bell Helicopter Corp., Braniff Airways, Slick Airways, Southwest Airmotive, Dallas Airmotive and others already operating in the area and the expansion in business flying and avionics and missile activities, there is little doubt that the Southwest is destined to play an important role in the future of aviation. And AVIATION WEEK will be there to provide more of the on-the-spot type of coverage by staff experts that has made it the leading publication in its field.

—Robert Hotz



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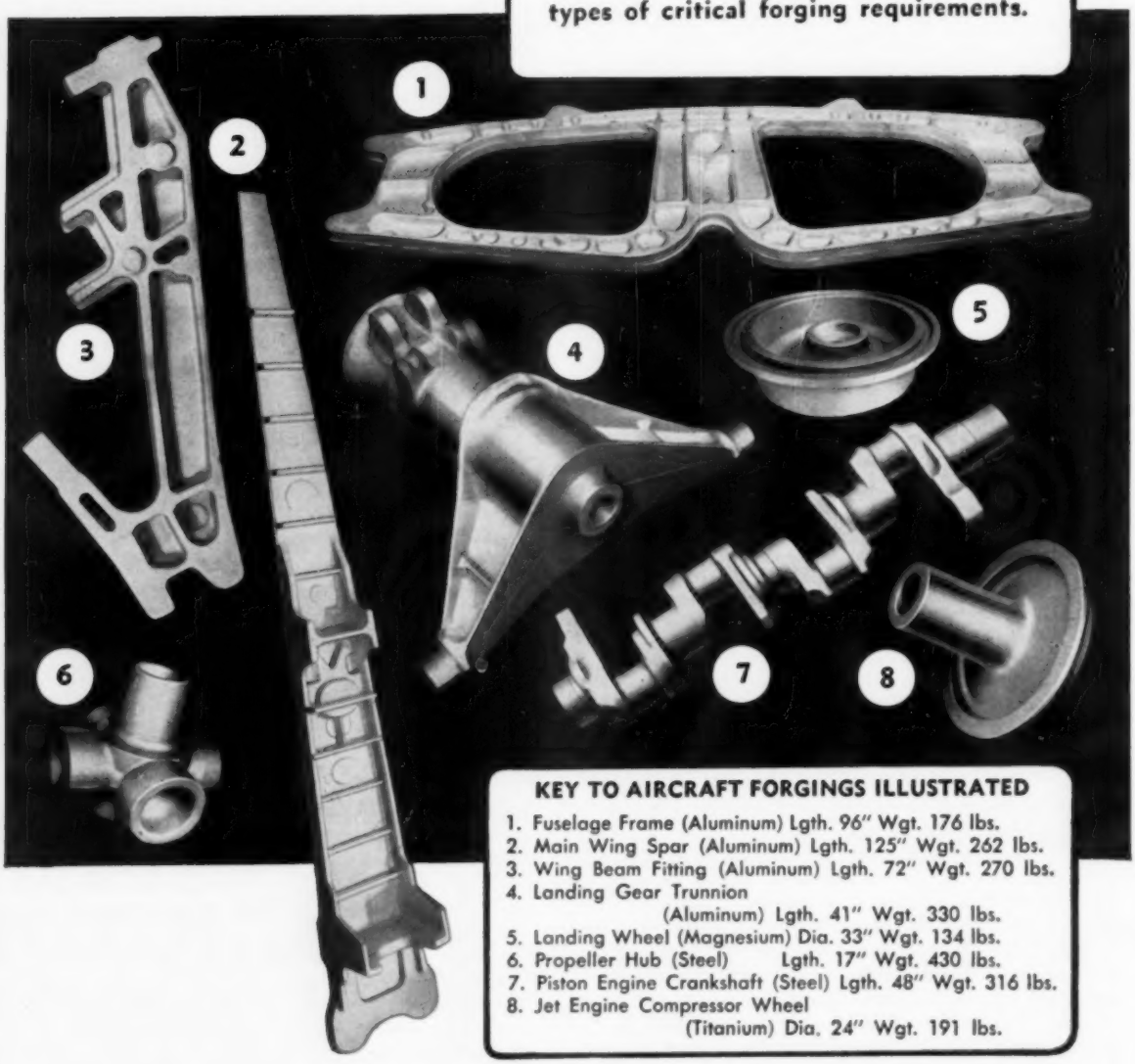

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William R. Whittaker, chairman and president of William R. Whittaker Company, Ltd., board chairman, Telecomputing Corp., Van Nuys, Calif. Mr. Whittaker succeeds **Ward W. Beman**, now vice chairman. Also, **George P. Brubaker**, chairman and president of Brubaker Electronics, Inc., a director.

Raymond A. Rich, president and director and executive committee member, Avco Manufacturing Corp., New York, N. Y.

Erwin J. Kaiser, staff vice president-manufacturing, Giddings & Lewis Machine Tool Co., Fond Du Lac, Wisc. **George K. Cassady** succeeds Mr. Kaiser as general manager, Davis Boring Tool Division.

Leddy Greever, vice president-commercial sales, and **Michael G. Neuburger**, vice president-export sales, Beech Aircraft Corp., Wichita, Kan.

Richard F. Sentner, executive vice president-commercial, United States Steel Corp., Pittsburgh, Pa. Mr. Sentner succeeds **David F. Austin**, retiring Dec. 31.

Col. Ben Artzi appointed director of El Al Israel Airlines, Ltd.

Honors and Elections

Gen. Alfred M. Gruenther will receive the 1956 James Forrestal Memorial Award from the National Security Industrial Association on Feb. 28. The award is presented annually to "a distinguished American whose leadership has promoted significant understanding and cooperation between Industry and Government in the interest of national security."

Robert W. Prescott, president of the Flying Tiger Line, Inc., has been elected 1957 board director of the Air Transport Association of America. New board members are: **C. E. Woolman**, Delta Air Lines, Inc.; **J. H. Carmichael**, Capital Airlines, Inc.; **Clarence Belinn**, Los Angeles Airways, Inc.; **Nick Bez**, West Coast Airlines, Inc.

Changes

Frank H. Andrix, director-engineering, Avionics Division, Bell Aircraft Corp., Buffalo, N. Y. Also: **Joseph D. Schantz**, assistant to division manager; **Robert C. Sellers**, sales manager; **Howard H. Herod**, contract administrator.

Donald C. McDonald, director-engineering, Friez Instrument Division, Bendix Aviation Corp., Baltimore, Md.

Group Capt. S. O. Tudor, chief liaison officer, Bristol Aero-Engines Ltd., Bristol, England. Also: **Air Commodore B. A. Casey**, deputy chief liaison officer, and **L. C. R. Phillips**, engineering liaison dept.

A. J. Pegg, formerly chief test pilot, now general service manager, Bristol Aircraft Ltd., Bristol, England.

Max M. Tall to head reliability program-missile control projects, Radio Corporation of America, New York, N. Y.

INDUSTRY OBSERVER

► U. S. Army will purchase three French Djinn pressure-jet helicopters for evaluation by Continental Army Command's Board 6 at Ft. Rucker, Ala. The helicopter, manufactured by Ouest, carries a pilot and observer.

► **Prototype of the Leduc O22 supersonic interceptor is nearing the flight test stage. Unlike its Leduc O21 predecessor, which was carried aloft by a mother ship, the Leduc O22 will take off from the ground. Powered by a Snecma Atar turbojet, the aircraft will have an estimated speed of Mach 2 and weighs approximately six tons. A second O22 prototype is now under construction.**

► Marquardt Aircraft Co. has been named a prime Air Force contractor for studies toward the development of advanced nuclear propulsion systems. The Van Nuys, Calif., company is now producing ramjet powerplants for Boeing's Bomarc interceptor missile.

► **Lycoming Division of Avco Manufacturing Corp. has been awarded a $1,140,000 USAF contract for product improvement on the T53 turboshaft engine. T53, which utilizes the free turbine power principle, will power the Bell YH-40 helicopter.**

► New reconnaissance techniques being used by the Air Force include a built-in wire recorder to record remarks made during visual reconnaissance and a special color film that reproduces living foilage in orange, leaving camouflage netting and paint to stand out in sharp contrast.

► **Air Force Cambridge Research Center is pushing research into ways of suppressing or eliminating aircraft exhaust condensation trails which aid enemy detection of high-altitude aircraft. New contracts include one for $38,861 to Meteorology Research, Inc., of Pasadena, Calif., and another for $38,494 to the Carnegie Institute of Technology.**

► Vertol Aircraft Corp. is studying the South American market with the main emphasis being directed toward offshore oil activity in Lake Maracaibo, Venezuela. Lacking a certificated helicopter for use in the U. S. until the H-21 qualifies for service, Vertol presumably is free to offer the aircraft to Latin America in its present configuration.

► **Lockheed Aircraft Corp. has been granted an $18,951,360 contract for T-33A aircraft, spare parts and ground support equipment.**

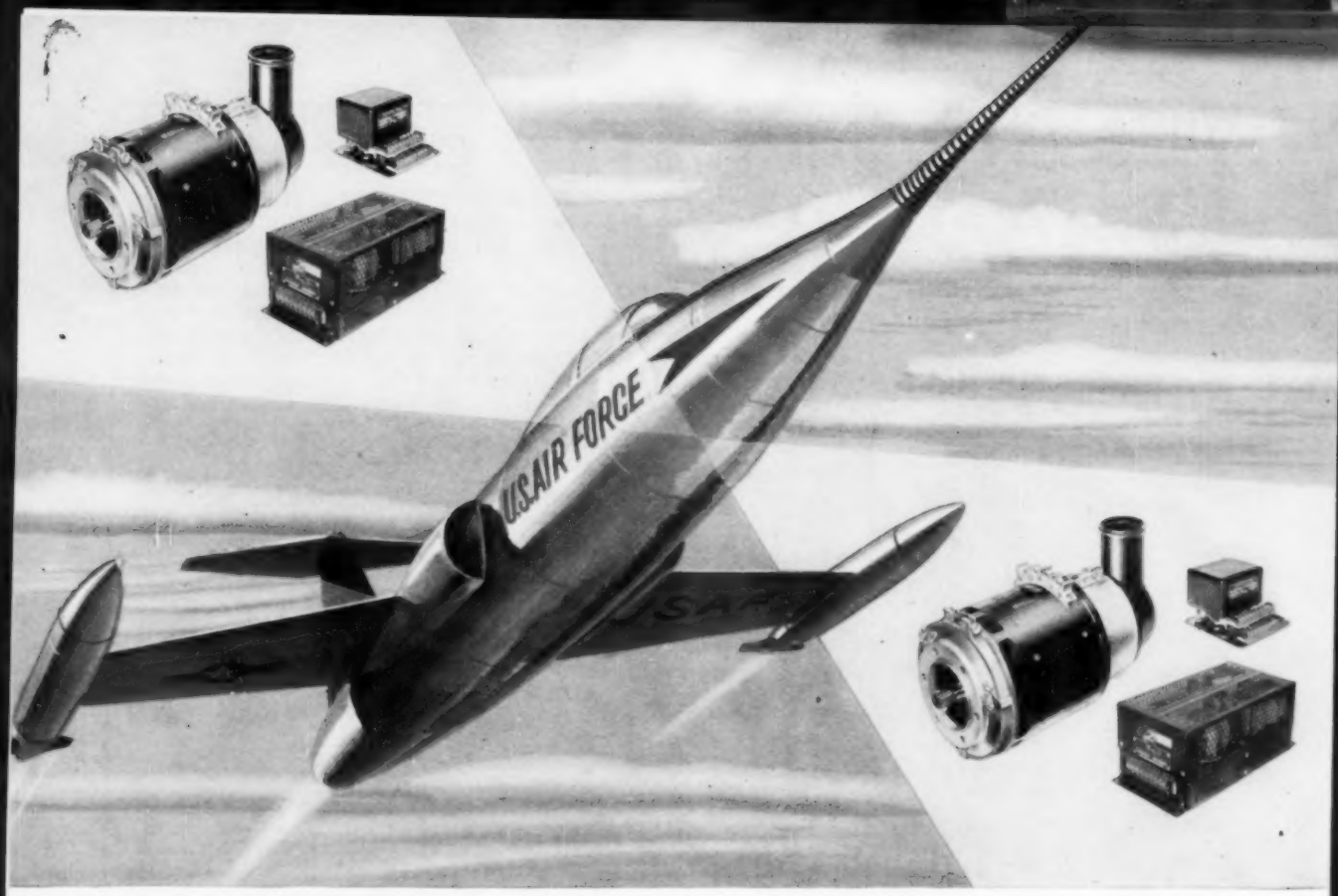
► Collins Radio Co. has developed a lightweight VHF communications receiver for the airline-business aircraft market with 880 channels, more than twice the number of its predecessor. Weight is approximately 10 lbs., or one-third that of earlier models. The new VHF receiver, the 51X-2, provides 50 kc. channel spacing over 108 to 152 mc. band.

► **All American Engineering Co., of Wilmington, Del., is designing a new-type aircraft arresting system for Navy's Bureau of Aeronautics. Designation is the T-12. The system will differ mechanically from all American's TM-4 "water squeezer" expeditionary arrester designed for the Marine Corps (AW Dec. 10, p. 34). Test location for the T-12 has not yet been determined.**

► Snecma plans to convert its vertical-takeoff test rig for the flying Atar turbojet engine into a coleopter with the designation C-450. First step will be the installation of a pilot's cockpit with tipup seating. Later, the rig will be equipped with an annular wing. At present, the vehicle is radio controlled from the ground.

► **Hughes Model 269 two-man helicopter (AW Dec. 17, p. 23) will be powered by a Lycoming piston engine and equipped with a single rotor. First demonstration flight on Dec. 13 was witnessed by Gen. Willard G. Wyman, head of the Continental Air Command, and a dozen Army evaluation personnel.**

► Air Materiel Command has signed a $9,870,000 contract with International Business Machines Corp. for optical and radar bombing-navigation systems for the Boeing B-52.



BENDIX DUAL GENERATOR SYSTEM HELPS MAKE LOCKHEED F-104 WORLD'S FASTEST FIGHTER

Jet-Age Advantages Offered By Bendix System:

High-temperature AC generator: 20 KVA, 400-cycle, 3-phase unit operating in 4800 to 7200 rpm range. Generates 120/208 volts. Exceeds Class "C" military requirements. Advanced design, including oversized exciter, permits taking very heavy intermittent loads "in stride". Driven directly by engine for increased reliability, less maintenance, over-all weight savings.

Magnetic amplifier voltage regulator: Completely static design eliminates all moving parts. Silicon rectifiers eliminate operating difficulties ordinarily encountered at high temperatures. Special vibration-resistant construction eliminates need for vibration isolaters and thus conserves critical space.

Automatic control panel: Hermetically sealed, environmental-free unit provides complete system control. Pilot operates entire automatic system from single toggle switch.

Supplying electrical power to the Air Force's top-performing Starfighter is a job calling for all-out performance and reliability.

The Bendix AC generator setup aboard the F-104 is a *dual* system, with either system able to handle the entire electrical load alone, if necessary. Developed by Bendix Red Bank Division, the system has many advanced features and advantages (see adjoining column) that enable it to answer the many difficult problems arising from the complex needs of an airplane that can climb with the speed of sound.

Our experience, manpower and facilities have produced *many* "firsts" and "bests" in the aircraft generator system field. Perhaps we can come up with a better answer to your needs, too. RED BANK DIVISION, BENDIX AVIATION CORPORATION, EATONTOWN, NEW JERSEY.

West Coast Office: 117 E. Providencia, Burbank, Calif.
Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.
Canadian Affiliate: Aviation Electric Ltd., P. O. Box 6102, Montreal, Quebec.

Red Bank Division

Bendix
AVIATION CORPORATION

Washington Roundup

Missiles and Fiscal '58

Most definite statement concerning USAF's Fiscal 1958 budget plans was made last week by Chief of Staff Nathan F. Twining who said 35% of Air Force procurement money will be spent on missiles. By 1961, Twining anticipates that the split will be 50-50 between aircraft and missiles. Obviously, the figures reflect more rapid development progress and increased production orders for missiles. In Fiscal 1957, $1.3 billion was allotted for the procurement of pilotless weapons.

Gen. Twining is expressing increasing concern over the challenge missiles now offer the Air Force as the time nears when they must be fully integrated into combat units. "Our problem," he said, "will be one of when and how to substitute missiles for aircraft without endangering our security at any time along the line. Just as new aircraft have led us to certain changes in our organization structure, it is more than likely that missiles will create the need for entirely new structures."

Pyle, CAA Administrator

Look for White House announcement of the appointment of James T. Pyle as Administrator of the Civil Aeronautics Administration. Pyle, who has been serving as acting administrator since the death of Charles Lowen last September, had not figured strongly as a candidate for the post although his record in implementing the CAA three year plan for federal airways is one of the chief reasons behind his appointment. He was named deputy assistant to Lowen on March 20 after serving as special assistant to the Assistant Secretary of the Navy for Air since 1953. A graduate of Groton School and Princeton University, Pyle holds a commercial pilot's certificate and has logged more than 4,000 hours in single and multiengine aircraft. He also has completed courses in aviation mechanics, meteorology and air transportation.

White House Squeeze

Watch for increasing pressure from the U. S. government to increase the competitive advantage of European airlines at the expense of U. S. flag carriers operating over the North Atlantic. Pressure comes directly from the White House where President Eisenhower is deeply concerned with increasing the dollar earning capacity of European allies hit hard by the Suez crisis. Among the first indications of this new policy will probably be capitulation to KLM Royal Dutch Airlines' demand to service Houston and Los Angeles (AW Dec. 10, p. 25).

Trans American, Another Blow

Trans American Airlines lost the next to the last round in its struggle to stay in business last week when the Court of Appeals upheld the Civil Aeronautics Board's decision of July 1955, to revoke the operating authority of the Trans American carriers. The nonscheduled carrier will make a final attempt to stave off revocation with an appeal to the Supreme Court.

The court upheld the CAB on all points of contention, finding that Stanley D. Weiss, James Fischgrund, Jack B. Lewin and R. R. Hart controlled the Trans American combine and that the Trans American carriers banded together to operate an integrated, regular air service. The court agreed with the CAB that the nonsked's operation violates several sections of the Civil Aeronautics Act and found that the Board had ample authority to order revocation.

Trans American's efforts to disqualify CAB member Harmar D. Denny from participation in the case have been rejected by the Board, and the court supported its action. The carrier's contentions that it was unlawfully denied access to necessary CAB documents also was rejected by the court.

Traffic Control Policy

The White House is expected to receive recommendations toward solving the present air traffic control and airways system tangle on May 1 from Edward Curtis, presidential assistant for Aviation Facilities Planning Group. Airways users will hear proposals for facilities from engineers and manufacturers in mid-January and then submit their recommendations to Curtis. The General Aviation Facilities Planning Group will present a draft of its studies to Curtis in February. Report to President Eisenhower will be in three sections—operations, facilities and administration. The latter section is likely to include the most drastic recommendations, since Curtis feels that inanimates such as equipment can be adjusted to fit changing requirements, but that the animates of personnel organization must be firm enough to maintain rigid control of the overall system on a long-range basis.

Write and Rewrite

Rep. John Moss (D-Calif.), chairman of the House Government Information Subcommittee, has asked Defense Secretary Charles E. Wilson to give a "comprehensive" explanation as to why the Defense Department's Office of Security Review insisted that changes be made in a speech USAF Secretary Donald A. Quarles was to deliver on May 16 when the identical speech already had been cleared, without the changes, for delivery on March 15. Quarles' remarks, with notations as to changes required by OSR:

"Early this year the Soviet Defense Minister claimed (OSR crossed out 'claimed' and wrote above it 'announced') that the Soviet Union was now 'protected by diverse atomic and thermonuclear weapons, powerful rocket-propelled and jet-propelled armaments of various types, including long-range missiles.' He asserted clearly (OSR crossed out 'asserted clearly' and wrote it 'claimed') that they now have both (OSR crossed out 'both') the means and the intent (OSR crossed out 'and the intent') to deliver nuclear and thermonuclear bombs against the Continental United States in the event a new conflict breaks out (OSR deleted 'in the event a new conflict breaks out')."

Missile Guiding Station

Basic agreement has been reached with Brazil on the lease of the island of Fernando de Noronha in the South Atlantic in order to extend the Air Force's guided missile tracking system. The system is routed from USAF's launching site at Patrick AFB, Fla., 5,000 miles south to Ascension Island. Fernando de Noronha, about 4,000 miles from Patrick, was the last roadblock to developing the track testing area. The agreement with Brazil involved lengthy negotiations and was reached only after the personal intervention of President Eisenhower.

—Washington staff

MODIFICATIONS of F11F with J79 installation include larger engine inlet ducts. Single-pane clear windshield was added.

F11F Sets New Speed, Altitude Marks

Tiger equipped with G.E. J79 hits 1,220 mph., reaches 72,000 ft. Grumman wants official try.

By Robert Hotz

Washington—Grumman F11F-1F Tiger fighter powered by a General Electric J79 turbojet has unofficially broken both the world speed and altitude records now held by British aircraft.

The Tiger, built for the Navy as a carrier-based fighter, has flown slightly more than 1,220 mph. (Mach 1.85) in level flight at 40,000 ft. and has reached an altitude of more than 72,000 ft. World speed record is 1,132 mph. set by the Fairey Delta FD.2 research plane in March. An English Electric Canberra bomber powered by two Bristol Olympus turbojets holds the world altitude record of 65,889 ft.

The National Aeronautic Association has sanctioned the Grumman Aircraft and Engineering Corp. to make an official attempt on both the speed and altitude records. According to NAA contest rules, this sanction gives the Tiger a 90 day period in which to make these official runs before another U. S. contender would be permitted to try.

F-104 Also Contender

The other leading contender for both speed and altitude records is the Lockheed F-104A fighter, also powered by the General Electric J79 and being produced for the Air Force. F-104A unofficial performance has been in the same brackets as the F11F but Lockheed has not yet requested official record runs from NAA.

Current U. S. speed record is 1,015 mph. set by the Chance Vought F8U Crusader, also being built for the Navy as a carrier-based fighter. The F8U's U. S. speed record was made to win the Thompson Trophy last summer after an earlier attempt to set the first "over 1,000 mph." world speed record in 1955 had been vetoed by Defense Secretary Charles E. Wilson.

Record breaking performance of the F11F-1F has been demonstrated during flight tests at USAF Flight Test Center, Edwards AFB, Calif., where the latest version of the Tiger has been flying since spring. It has been flown by the company, Navy and USAF pilots, including Maj. Gen. Albert Boyd, deputy commander of the Air Research and Development Command for weapons systems, and Brig. Gen. J. S. Holtoner, commander of the USAF Flight Test Center.

Most of the maximum performance work on the F11F-1F has been done by Lt. Comdr. George Watkins, a test pilot from the Navy's Patuxent River, Md., test center assigned to Edwards for the Tiger project.

Performance Features

Among the many unusual features of the J79 powered Tiger performance are:

- **Sufficient fuel capacity** to make an attempt on both speed and altitude records feasible in a single flight.
- **Sufficient maneuverability** above 70,000 ft. to aim and launch guided missiles at targets either above or below the Tiger.

The Tiger is now in production for the Navy at Grumman's Peconic River, N. Y., plant in an earlier version powered by the Wright J65 turbojet. This

New Simulated Altitude Record

Wright-Patterson AFB, Ohio—New partial pressure suit has enabled an Air Force scientist to reach the record altitude of 198,770 ft. in a pressure chamber at the Air Research and Development Command's Wright Air Development Center.

The same suit, designated the MC-4, was worn in extreme high-altitude flights of the Bell X-2 rocket research plane, including Capt. Iven C. Kincheloe, Jr.'s, record flight to 126,000 ft. (AW Sept. 24, p. 29). It also was used by two Navy officers who recently reached 75,000 ft. in a balloon.

New simulated record was set by Maj. Arnold I. Beck, 43, of WADC's Aero-Medical Laboratory. The suit—which will replace the T-1 suit—eliminates reverse breathing, can be put on with no help (the T-1 required a helper), is more comfortable, gives more protection and allows more mobility than the T-1, according to ARDC. It includes an improved pressurized helmet and pressurized gloves.

The MC-4 is for use in fighters and includes an anti-gravity suit. The MC-3 version is for use by bomber crews. The David Clark Co., of Worcester, Mass., will produce the MC-3 and Berger Brothers Co., of New Haven, Conn., will make the MC-4.

Highest simulated altitude reached with the T-1 suit was 106,000 ft. Maj. Beck reached 155,000 in the MC-4 a few days before setting the new record.

LARGER aft fuselage section was necessary to house J79 afterburner. Leading edge extensions improve supersonic speed stability.

version was supersonic in level flight and was the first fighter in the world to incorporate the NACA-developed area rule for drag reduction in the transonic speed range.

An experimental installation of the more powerful General Electric J79 turbojet with afterburner was made in 1955 with initial flight tests conducted in the spring of 1956 at Edwards. Some structural modifications were required to fit the J79 into the Tiger airframe (AW Oct. 29, p. 28). These included larger engine inlet air ducts and a larger aft fuselage section to house the afterburner. The F11F-1F also has leading edge wing extensions for better stability and control at supersonic speeds and a single-pane clear windshield on the cockpit.

The F11F-1F is now operating with a Phase I version of the J79 turbojet rated at about 15,000 lb. thrust without afterburning. Grumman and the Navy anticipate substantial performance increases for the Tiger using a later and more powerful version of the J79.

Biggest hurdle the Tiger must clear to make an official speed and altitude record run is the Department of Defense. Although both USAF and Navy traditionally have been willing to allow their aircraft to make official record runs, Defense Secretary Charles E. Wilson personally vetoed several requests to do so from the services. Secretary Wilson objects to world record attempts on the grounds of alleged military security regulations. But technical experts in both services agree that there is no real security involved in either a climb to maximum altitude or a 15 to 25 kilometer straight and level speed run between 30,000 and 40,000 ft.—far below the operational level required of modern fighters.

At a Pentagon press conference, Secretary Wilson recently told reporters he was not interested in world records and indicated he felt they were trivia not worthy of consideration at his level. When Secretary Wilson authorized the Navy to make an attempt to set a new American speed record, the pilot, Comdr. R. W. "Duke" Windsor, was ordered to hold back his aircraft to as small a margin over 1,000 mph. as possible.

There also has been an unofficial policy established at the Defense Department level to alternate the American speed record between the Air Force and Navy, regardless of which service has the aircraft technically capable of holding the record. There has been widespread dissatisfaction with the Defense Department aircraft record policy in both the military services and the aircraft industry ever since the Pentagon rulings have permitted the record to go to England and stay there.

$24 Billion Balance

Washington—Air Force and Navy had an unexpended balance of $24 billion on hand for payments on aircraft and related procurement contracts as of Oct. 1.

This compared with $23.5 billion for the same date a year ago.

The unobligated balance, available for new contracting, totaled $12.3 billion, compared with $14.7 billion on Oct. 1 a year ago.

The unexpended $24 billion for aviation procurement was divided: USAF $17.2 billion; Navy, $6.8 billion. The $12.3 billion in unobligated funds was divided: USAF, $9.4 billion; Navy, $2.9 billion.

USAF aircraft procurement obligations totaled $2 billion net during the first quarter (July through September) of Fiscal 1957. During the same Fiscal 1956 period, cancellations exceeded new contracting by $30 million. New naval aircraft procurement obligations of $839 million for the first Fiscal 1957 quarter compared with $281 million for the same period a year ago.

British Leader Hits Weapon System Plan

Washington—Sir Arnold Hall, technical director of the Hawker-Siddeley group, criticized the weapon system design concept and entered a strong defense of Britain's aircraft industry last week in his 1956 Wright Brothers Lecture here.

Acknowledging that the British aircraft industry is facing a new flood of criticism at home and abroad, Sir Arnold argued that his country's current engines and aircraft are as good as, or better than, those of competitors. To support this he cited foreign sales and Great Britain's lead in jet transport design.

Sir Arnold cited a long list of difficulties that have badgered the British industry since World War II and concluded that there is room for criticism. But, he said, his country's aeronautical resources have been improved in the past five or six years with a large investment that should improve development work within the next decade.

Sir Arnold contended that the weapon system concept has slowed aeronautical development and said the concept can force project planning to "go adrift."

He argued that the emphasis placed upon having the aircraft, engine, radar, armament and other components developed in phase adds difficulties to the program by adding to the burden of technical work. He added:

"The practical difficulties soon become almost overwhelming. The designer of the wing wants to know the aerodynamics and loads of the weapons he must attach, but these are not yet fully designed; later, the weapon must be changed due to development snags, but this means changes in the wings when the jigs are completed and metal committed to them.

"This situation is multiplied many times over in a complicated system. If a new project is to come through reasonably quickly, it should be so conceived initially that the various elements that make it up are not all at the same state in their evolution and, in particular, are not all at the start of their evolution.

"By way of example, consider a fighter and suppose that the airframe represents a radical advance. I think the best progress, in time and in quality, will come from starting the new airframe around engines, radar and armament—or at any rate, two of them—which have reached or are approaching Mark I standard, and which are now proceeding in their evolution by development."

Sir Arnold said all elements of the weapon system should not be at the most advanced technical stage at the same time.

"By this staggering of the evolutionary stages of the elements in the system, I believe that a great deal of time can be saved," he said.

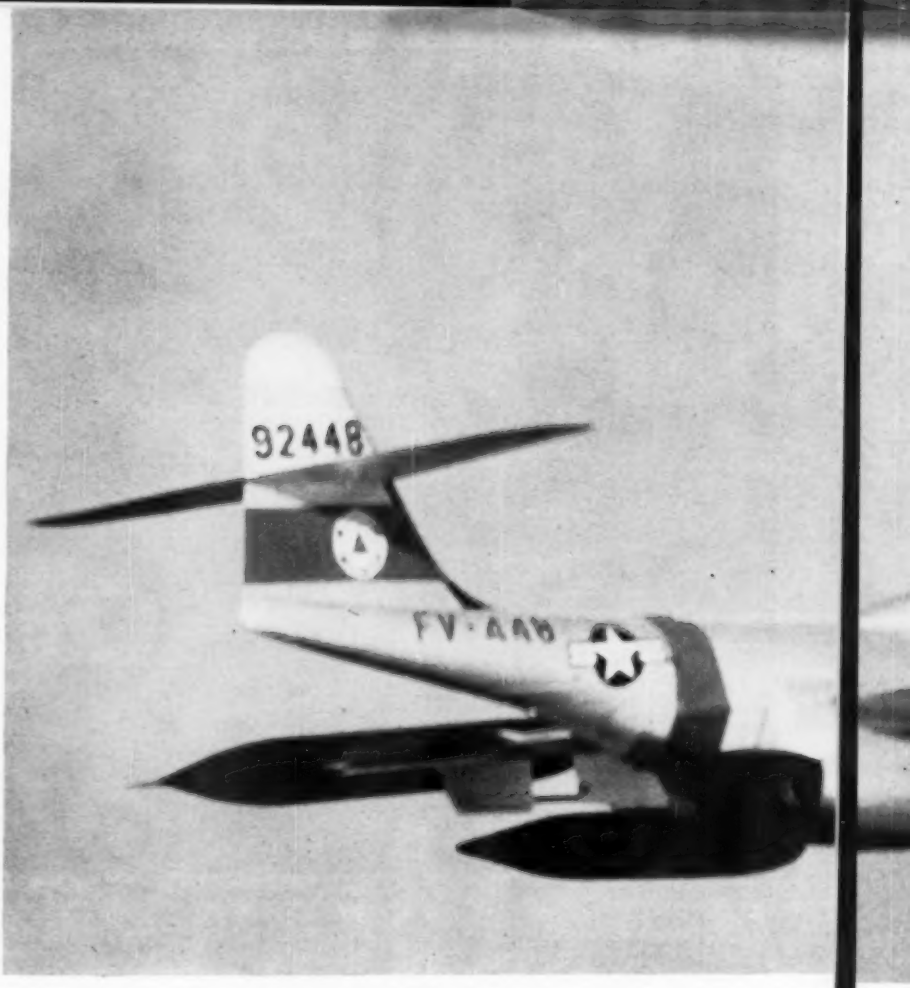
Wright Memorial Award

Washington—Dr. Edward P. Warner, council president of the International Civil Aviation Organization, was awarded the Wright Brothers Memorial Trophy for 1956 at the annual Wright Memorial Dinner last week. Dr. Warner was cited for "public service of enduring value to aviation in the United States."

A second major prize, the Frank G. Brewer Trophy, was given to Ray O. Mertes, Director of Schools and Colleges for United Air Lines. He was honored "for contributing the most to the development of air youth in the field of education and training."

The prizes were presented by Vice President Richard M. Nixon.

Start of B-52 jet bomber operations in 1956 was recognized with presentation of the Collier Trophy to William M. Allen, president of Boeing Aircraft Corp., and USAF Chief of Staff Nathan F. Twining (AW Dec. 17, p. 31).



Snark Extends Landing Legs

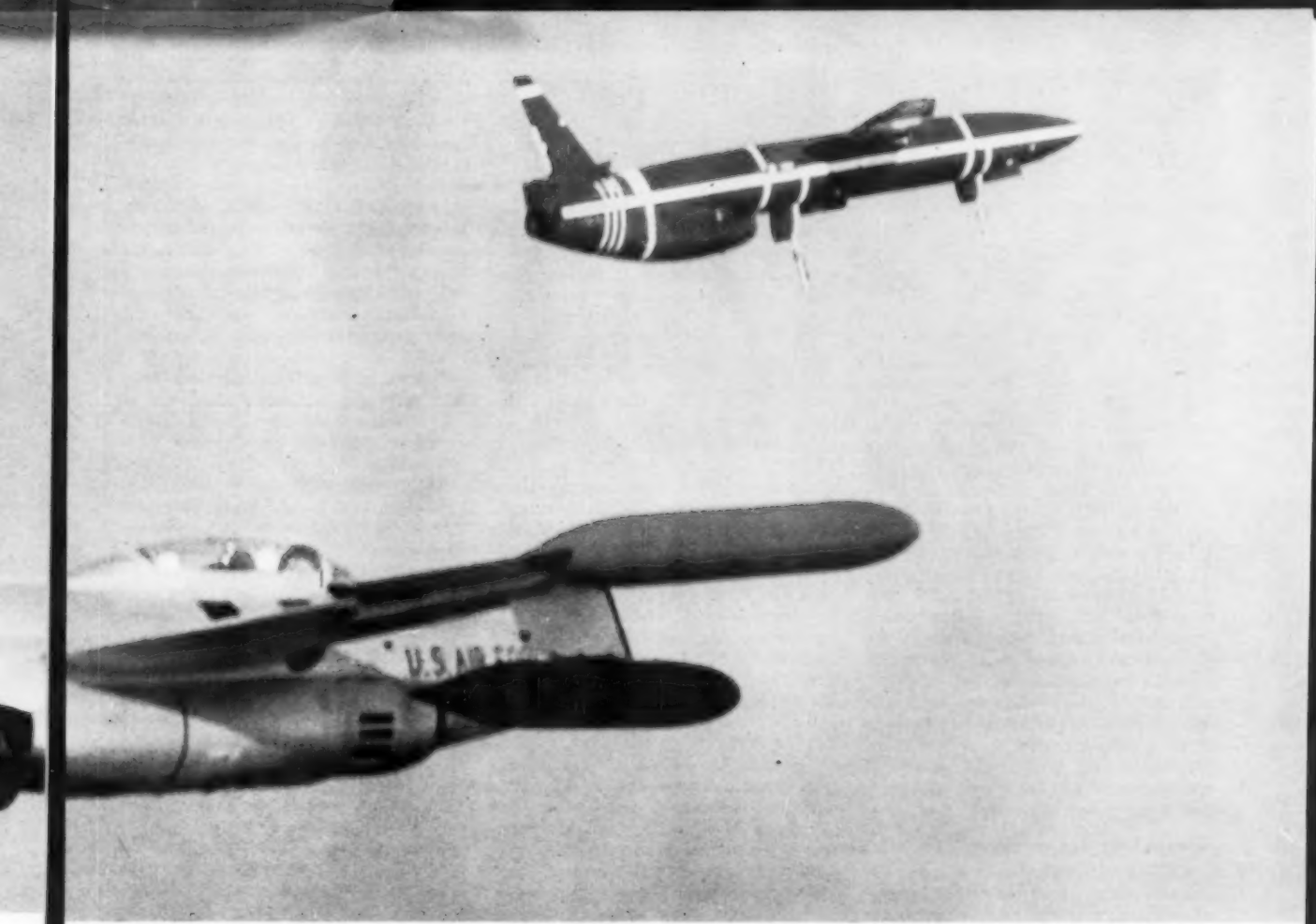
Molybdenum Idea Offers 2,500F Hope

Turbine inlet temperatures as high as 2,400-2,500F may result from use of unprotected molybdenum turbines running in non-oxidizing gas turbine cycles, according to a Navy spokesman.

These high turbine inlet temperatures would provide the breakthrough for engines which could cruise at approximately Mach 2.5 or better for three hours at a time.

(Such a craft could make New York to Paris in a couple of hours.)

Several companies have expressed interest in the necessary "non-reducing"



Snark on approach to landing strip at Air Force Missile Test Center, Cocoa, Fla., has its skid gear extended for landing. Gear is tandem shock struts with metal shoes at end of each leg which slide on the runway during landing. As missile slows, it tends to roll to one side or the other, and a small metal skid under the wingtip takes the secondary impact. Snark approach is directed by command from the Northrop F-89 Scorpion and after final approach is landed by ground control. Snark was developed by Northrop Aircraft, Inc.

gas turbine cycles, a Climax Molybdenum Co. source said. The two leading approaches are inert-gas closed-cycle and fuel-rich open-cycle.

Navy's Bureau of Ordnance has a contract with Experiment, Inc., Richmond, Va., which, although not specifically for aircraft powerplants is expected to "have some intriguing results pertinent to aircraft."

Helium or argon inert gas might be used in a closed loop cycle with the fuel energy added by a heat exchanger or a conventional open cycle might be used which is so fuel-rich that the unprotected molybdenum won't be oxidized away. This allows molybdenum's superior strength at high temperatures to be utilized directly. Most of the present means of protecting molybdenum are not only expensive and of doubtful reliability, but are not expected to raise the cycle temperature much over 2,000F.

Problems of this direct use of molybdenum are formidable but it is possible that exigencies of future aircraft progress may demand their solution. The weight and bulk of the closed-cycle heat exchanger is discouraging but for certain nuclear powerplants which would use heat exchangers anyway, the higher turbine inlet temperature may help compensate for the weight and bulk of both the heat exchanger and the shielding.

The idea of fuel-rich combustion for open-cycle turbines, which at present need their extra air for cooling, also sounds impossibly forbidding, but the additional fuel could be injected just before the turbine so that it only had time to mix but would not start to burn until it reached the afterburner downstream.

Jet Training Program Announced by CAB

Washington—Civil Aeronautics Administration last week announced a jet training program for key safety inspectors and flight test engineers that will include various phases of flight training with a Lockheed T-33 jet trainer and two F-80C Shooting Stars.

The training program will be conducted at the CAA Aeronautical Center, Oklahoma City, where a Link jet trainer already has been recently installed.

During 1957, approximately 30 CAA officials will receive 30 hours each in the jet aircraft.

The three planes are on loan from the Air Force.

CAA also has borrowed two Martin B-57 Canberra-type bombers from the Air Force for use in the higher-altitude checking of the various navigation and communication facilities (AW July 16, p. 43).

At present the program plans include advanced training in these two aircraft if they can be spared from the airways program.

CAA mechanics who will maintain the jet planes are scheduled to begin training Feb. 1 at Sheppard Air Force Base, Texas.

Single Sideband Challenged for Airline-Military Communications

By Philip Klass

Washington—Claims and counter-claims, reminiscent of the early Tacan-DME controversy, are passing between proponents of three different types of long-range high frequency (HF) communications systems, each seeking airline and military acceptance.

Single sideband (SSB), until recently the unanimous airline-military choice as the successor to long-used double sideband (AM) systems, has run into strong competition on two fronts.

One is the General Electric developed synchronous detection technique (first reported in AVIATION WEEK, Oct. 15, p. 81), a system that eliminates the radio frequency carrier but uses both sidebands. The other is a compatible single sideband (CSSB), developed by Kahn Research Laboratories, which uses a carrier and one sideband.

The SSB system recommended by the International Civil Aviation Organization and under development by Collins Radio Co. for the USAF's Rome Air Development Center, uses no carrier and a single sideband.

Competing Techniques

Difficulty of evaluating claims and counter-claims made in behalf of, or against, each of the three systems has prompted Aeronautical Radio, Inc. to propose a symposium to be held soon. Proponents of each system could present its advantages and answer objections or questions raised by competitors and airline/military representatives.

Rome center spokesmen told AVIATION WEEK that there are certain advantages and disadvantages for SSB and synchronous detection, "with no solid edge for either system, based on very limited experience to date." The center has not tested the Kahn CSSB system.

The situation needs quick resolution. When the International Telecommunications Union meets in 1959, it is expected to press for world-wide adoption of frequency conservation techniques, as SSB, to make maximum use of the radio spectrum. Although this meeting is more than two years off, a great deal of advanced planning must precede it and the U. S. already has started.

Next fall the ICAO Sixth Communications Division meeting has scheduled an agenda item calling for preparation of standards and recommended practices for single sideband communications. Planning for this conference within the U. S. and elsewhere must get underway shortly.

Both the Air Force and airlines are anxious to resolve the situation as soon as possible in order to proceed with long-range implementation plans. Arinc, which had been preparing a single sideband airline equipment specification, has decided to withhold its issuance until the question is resolved.

Suppressed carrier SSB, such as Collins is developing, should theoretically double the number of channels available in the congested radio spectrum. (AW April 30, p. 62; May 7, p. 75). The CSSB system developed by Kahn can provide almost the same spectrum economy, according to its inventor, Leonard Kahn. However, this claim is disputed by supporters of the synchronous detection and suppressed carrier SSB systems.

General Electric agrees that synchronous detection does not provide any spectrum saving for voice communications, but contends it does offer the same or greater increase in intelligibility and effective power as SSB does over existing AM.

However, Dr. John P. Costas of General Electric claims that synchronous detection is the only one of the three systems that could be used for pulse-coded communications (data link) which might eventually replace voice and provide a 50:1 bandwidth saving.

Against this claim, some experts express doubts whether pulse coded communications are at all feasible in the HF band because of the difficult propagation characteristics at these frequencies.

Selection Complications

Doppler frequency shift, resulting from airplane speed relative to the ground station, threatens to be a serious problem for suppressed-carrier single sideband, particularly for high-speed military jets. However, this is no problem for CSSB or synchronous detection, its supporters point out.

These are but a few of the conflicting claims which have prompted Arinc's William T. Carnes to suggest that the principals be brought into a single area to thrash out the conflict.

The selection of the best system cannot be made solely on the basis of the system's present or potential future performance, Carnes points out. The problem of transition from the present AM system to the selected system is equally important.

Arriving at a wise decision is made more difficult because relatively little experience has been gained to date with any of the three systems. Single sideband has been used for many years for point-to-point communications, but the Collins equipment slated for delivery to Rome Air Development Center next year will be the first specifically designed for ground-air use.

General Electric has delivered several experimental synchronous detection transmitters and receivers to the center, but these have been used only for point-to-point tests on a laboratory basis.

General Electric also agrees that considerable work remains before the new technique would be ready for production hardware.

Kahn's CSSB reportedly is being used on a very low frequency Voice of America transmitter in Europe and is slated for tests by a New York City commercial radio station, WMGM.

None of the three systems has undergone the operational service tests that both the airlines and military normally seek before making a commitment with far reaching consequences.

Views on Choice

Arinc's Carnes believes that if an airline decision is reached to proceed with SSB, it will eliminate synchronous detection as a contender because the latter can not operate without both sidebands. However, a Rome spokesman was not so pessimistic. He believes that dual-mode receivers can be designed to operate either single sideband or synchronous detection fashion.

If the airlines decide to proceed with single sideband, it might open the domestic airline market to Kahn's CSSB, Carnes believes. The latter offers spectrum saving and improved performance over existing AM, according to Kahn, yet should be less complex and less costly than suppressed carrier single sideband. Domestic carriers, which make less use of HF communications than their international counterparts, might find it hard to justify the added cost and complexity of pure SSB and might therefore buy compatible Kahn-type single sideband, Carnes says.

Lords Ask Inquiry Into Air Industry

London—Several members of the House of Lords have called for an inquiry into Britain's "pampered" aircraft industry, a request the government has promised to consider.

Declaring that the British aircraft industry is and has been for a long time a "pampered" industry, Lord Ogmore asserted, "We feel that the industry is concentrating upon producing a product so expensive that it may price itself out of the market."

No longer is there a military or civilian need for such a large number of aircraft firms in Britain, he asserted, and it is a "very much swollen" industry

which is wasting technical manpower.

"These companies are subsidized directly by the state," Lord Ogmore said, "and where they are not subsidized directly, then they are subsidized indirectly. They are subsidized through research, through the facilities they have at the Royal Aeronautical Institution at Farnborough, through orders for prototypes by the Ministry of Supply, through purchases of types that have not been very successful and through grants and contracts of one kind and another. Therefore we feel that a much smaller and more compact industry is needed."

To insure that this reduction in the number of aircraft firms takes place in the most efficient possible way, he said, an inquiry should be instituted.

A government spokesman replied that this "rationalizing" of the industry already is accepted policy and added, "We are certainly anxious that it should take its course. We do not feel that we can press it on the industry unless the industry shows that it feels it is a desirable course."

British 5-Jet VTOL Begins Taxi Trials

London—Britain's first vertical takeoff plane, the Short SC 1, made its first taxiing trials at Belfast.

Described as a pure research project, SC 1 was originally known as the PD 11 and was first disclosed by Supply Ministry in November 1955.

Spokesman for Short Brothers and Harland said after the tests that "all went well."

Plane is powered by five Rolls-Royce RB108 turbojet engines. Thrust from all five engines is used for lifting, but observers were unable to determine engine configuration or deflection system used for vertical flight. Gross weight is estimated at 7,000-10,000 lb.

Engine is a development of the Rolls-Royce Soar turbojet redesigned for longer life and podding. Soar developed 1,800 lb. thrust.

One observer said there was no swiveling arrangement for engines. He estimated forward speed was not higher than 300 mph.

Transition between forward and vertical flight is believed to be governed by a computer acting as autostabilizer.

Next test procedures:

- **Prove SC 1** as conventional aircraft beginning in January.
- **Hovering** with aircraft tethered in a new test gantry now being constructed at Belfast.
- **Unrestricted takeoff** and landing.

Britain's pioneer vertical takeoff project, the Rolls-Royce Flying Bedstead first revealed in September 1954, was little more than a jet powered platform not able to fly horizontally.

FRENCH cutback in orders for interceptors includes Dassault's Super Mystere.

French Plan Order Cutback for Super Mystere, Twin Jet Vautour

Paris—French Air Ministry plans a cutback in the number of orders already placed for Ouest Aviation's twin jet Vautour and Dassault's Super Mystere interceptor.

Originally Air Ministry ordered 360 Vautours and 350 Super Mysteres. Deliveries of both production models are just getting underway. How deep cuts will be is unknown, but they probably will not affect 1957 delivery schedules.

Action was taken presumably because Air Ministry realized full order on both craft would not be filled for several years, by which time both obviously would be obsolescent. For example, present production schedules on Vautour will permit only about 50 of this craft to be delivered to the French Air Force during 1957.

Many French air force observers complain that the interceptor version of the Vautour cannot fly fast enough or high enough to intercept known Russian bomber potential. Vautour is made in three versions: all weather interceptor, ground attack and bomber.

It is possible the money-short Air Ministry is cutting back present orders in order to conserve funds for ordering more advanced types of aircraft. Ouest Aviation is building an advanced version of Vautour which reportedly is a twin jet, low wing configuration with 45 deg. sweepback. New version is called SO 6040. Dassault has several advanced type interceptors, such as Etendard and Mirage, which up to the present have not been ordered by the air force.

Necessity of cutback is being cited here as another example of need for French aircraft industry being run on European rather than national scale. Industrial officials here say such cutbacks are inevitable since national industry does not have capacity to deliver a large order in quick enough time to keep aircraft from becoming obsolescent before they are delivered to squadrons.

Georges Glasser, Ouest Aviation president and also president of the French Aircraft Industries Assn., who long has been urging European scale industry, reportedly will resign his post at Ouest Aviation and quit the industry altogether. It is unknown whether Glasser's resignation has any connection with Vautour cutback.

USAF Finds British Sensitive Over Fuel

London—USAF personnel in Britain will receive supplemental gasoline rations to maintain units at combat capability but have been warned not to discuss this with fuel-hungry British citizens.

Air Force has emphasized this ration strictly is for "business" travel and that any use of it for pleasure will result in severe measures.

Cautious attitude results from a number of anti-American incidents which have developed since Suez crisis. Some American airmen have reported refusals to serve them in British pubs, and British service stations have refused to sell gasoline to many.

There is no provision in Britain for service personnel to buy gasoline on bases. In spite of this, one isolated USAF base found it necessary to make gasoline available for private automobiles of its personnel because they were turned away at British service stations.

There also have been reports of slashing of tires on automobiles owned by American servicemen.

Boeing Will Continue Renegotiation Duel

By James Dailey

New York—Boeing Airplane Co., perennial leader in the fight against renegotiation, served notice last week that it will carry on the battle in the tax courts and the coming session of Congress.

Despite the extension of the act for two years in the final days of the last session, the fight is by no means over, Clyde Skeen, Boeing controller, told the New York Society of Security Analysts last week.

"It appears mandatory that Congress review the objectives of the Renegotiation Act and advise the Statutory Renegotiation Board accordingly," Skeen said. "If it is the intent of Congress to restrict profits arbitrarily, it can be accomplished much more simply than by the complicated, time consuming and expensive process of renegotiation. We do not believe this is the intent of Congress."

Profit Report

Skeen quoted Rep. Edward Hebert (D.-La.), chairman of the House Armed Services Committee which investigated the problem last summer, as concluding after a review of 12 leading aircraft companies that average profits were not excessive.

"We do not believe, therefore," said Skeen, "that Congress can ignore the renegotiation problem. It is vital, not only to the airframe industry but also to the defense of the nation, that realistic objectives be established and positive administrative direction be given the Renegotiation Board."

Skeen indicated renegotiation battle plans so far were not firm, but would take the form of retaliation and attrition. Representatives of his and other companies will appear before Congressional committees to bring the problem before the public and lawmakers, will try to have amending legislation introduced and passed, and work toward moving appeal machinery from the tax courts to the U. S. Court of Appeals and the Supreme Court. Currently, the decision of the U. S. Tax Court in renegotiation cases is final.

Tax Court

Boeing has pending before the U. S. Tax Court an appeal to throw out a Renegotiation Board finding that the company earned $9,822,340 in excessive profits in 1952 (AW Jan. 23, p. 30). The company said Congress should control profits only in times of "grave national emergency" and no such emergency existed in the period involved.

What happened in 1952, Skeen said, was that $5.8 million of the company's total renegotiable profits were earned as a reward for efficient cost performance under fixed price incentive contracts, and another $1.7 million was earned as compensation for establishing two of Boeing's competitors as manufacturing sources for the B-47.

Supplied Assistance

The company did this, he said, by supplying technical assistance, training supervisory people and furnishing major sections for the first few airplanes delivered by each company.

"We therefore had every reason to be proud of these two items as reward for our finest efforts in 1952," he said. "The Renegotiation Board's finding, of course, effectively took away this $7.5 million plus another $2 million additional."

Skeen brought out the difficulty of determining profits in the industry "with any degree of accuracy" under the present renegotiation law. And he said that the Boeing case for 1952 seems to have established a pattern, based on reports from two principal aircraft companies, which indicates that other aircraft prime contractors will have to face penalties for their volume increases for 1953 and subsequent years. Boeing was the only West Coast aircraft company assessed excessive profits for the year 1952.

Skeen said Boeing's most vulnerable point in 1952 was the "net worth criterion—a wholly invalid means of determining reasonableness of profits."

He cited these reasons:

- **Book net worth** or invested capital is by no means indicative of the true worth of a company.
- **No consideration** is given to efficiency nor to the reasonableness of costs of articles furnished.
- **Earnings** for a specific year are not recognized as the result of design, development and manufacturing cycle that extends over a number of years.
- **Contribution** to the defense of the country through the development of advanced weapons is not taken into account.

Fixed Contracts

Skeen contended that Boeing's earning rates have been well within the fixed contracts negotiated, and these rates resulted in only an approximate 2% net return on sales in 1952. He said that is why Boeing appealed its case, and he predicted other companies in the industry will follow, as they are cited.

The Boeing official made the point, too, that the prices for a substantial part of the 1952 business were negotiated with Air Force procurement personnel who had good knowledge of Boeing costs and operations, in addition to the same data from other companies for comparison testing.

Much of the business, he stated, was negotiated on fixed price-incentive type contracts which generally establish the final contract target price after an actual performance period. These contracts are designed to reward efficiency and at the same time enable the government to take advantage of the larger share of cost reduction—generally about 80%—while the contractor (in Boeing's case) received about 20%. Cost overruns also were borne proportionately.

"In other words," said Skeen, "we contend circumstances were such that proper initial pricing was accomplished."

Difficulty in the past, Skeen said, was that in times of peace there wasn't enough business to keep the industry busy, with the result there was a desperate struggle to keep many organizations together.

"But now," he said, "we have become somewhat encouraged by growing recognition of the importance of airpower and the recognition of its substantial contribution to the economic life of our country. We are encouraged with the apparent recognition of the necessity for long term planning to assure the best of weapons will be available at all times at the least possible cost."

"For those companies that merit the business," he said, "this should assure a more stable future."

Skeen said that Boeing fits that category well, with its Bomarc guided

Douglas Cited

U. S. regional Renegotiation Board has recommended that $9 million profits of the Douglas Aircraft Co. for the Fiscal year ended Nov. 30 be ruled excessive.

Clyde Skeen, Boeing controller, predicted before the New York Society of Security Analysts that at least two aircraft companies, would be so cited.

The recommendation to the Washington Board would require a refund of the excessive profits less adjustments for applicable state and federal income and excess profits taxes. This would indicate a possible net rebate of about $2,240,000. Latest Douglas earnings published reported a third quarter net of $20.5 million.

Douglas said it did not believe it had earned excessive profits. A hearing will be held before final determination, which Douglas then may appeal to the U. S. Tax Court.

'Everybody' Came to See Hustler Fly

B-58 Hustler was photographed from outside the fence at Convair's Ft. Worth plant (AW Dec. 17, p. 28) over the heads of a public crowd of 3,000 who jammed the highways coming to see the first flight. Man at left is one of many photographers, including those from Life and NBC-TV, who took pictures of the B-58 on its various flights. On the high ground across the field are residences and other public property from which the supersonic bomber could be observed. Drag-chute landing in this photograph was at conclusion of first flight. This and other exclusive B-58 photographs published in Aviation Week were made by Art Johnson.

missile program a potential business-getter, its KC-135 jet tanker-transport just getting into production, its Boeing 707 civilian jet transport with 134 orders, and its chemical bomber project, the WS-110A, about to come off the drawing boards.

Plastic 'Sub-Satellites' Proposed for IGY

Washington—Inflatable, extremely lightweight "sub-satellites" have been proposed to relieve the main satellites of part of their information gathering burden during International Geophysical (IGY) launchings.

This is one of about 30 proposed inboard Vanguard experiments now being studied by the IGY committee. Perhaps one-fifth of these will finally be approved.

Use of collapsible, aluminum-coated plastic sub-satellites was proposed to the committee by William J. O'Sullivan, Jr., aeronautical research scientist at the National Advisory Committee for Aeronautics' Langley Aeronautical Laboratory.

Their rigidity and high reflectivity should allow radar and visual tracking from the ground. Their high volume to mass ratio should give information on drag—and, therefore, density—more quickly and accurately than the far heavier main satellite.

Their use also should allow more flexibility in planning weight, size, instrumentation and outer coating of the primary satellite, since they would take over a part of the primary satellite's original function.

Diameter of the sub-satellite proposed by O'Sullivan is 20 in., the same as that of the primary satellite—but size could be increased easily. Weight of the 20-in. sub-satellite is less than one-quarter pound.

Basic material is Mylar plastic, 25 ten-thousandths of an inch thick. It is coated with six ten-thousandths of an inch of aluminum.

A small pressure capsule filled with hydrogen and attached to the sub-satellite would be used to inflate it after it was ejected from the third stage of the Vanguard rocket. Weight of the sub-satellite plus cartridge and container is 10½ oz.

SAC's B-47 Deterrent Airpower

Denver—USAF's Strategic Air Command has extended its demonstration of its deterrent airpower to the Boeing B-47 medium jet bomber.

In an intensive two-week exercise involving 1,000 B-47s, SAC tested their operational capability with non-stop missions averaging 8,000 mi., over the entire North American continent and the Arctic regions.

Announcing the test in a speech at the Air Force Academy, USAF Chief of Staff Nathan F. Twining said the missions "demonstrated our capability to launch a retaliatory strike force in minimum time."

The exercise closely followed a long-range demonstration by the B-52 jet bomber.

Eight of the larger aircraft flew non-stop polar flights of up to 17,000 mi. (AW Dec. 3, p. 31).

STROUKOFF YC-134, taking off, shows tandem main wheel system, which has new rocker arm support system. Assault transport, rolled out at Trenton, N. J., last week, also has an unusual boundary layer control system combining blowing and suction techniques.

YC-134 Marks Change in Flow System

By Russell Hawkes

Trenton, N. J.—Stroukoff Aircraft Corp.'s YC-134, rolled out at the Mercer County Airport here last week, displayed an unusual boundary layer control system that combines suction at the inboard flaps with blowing over outboard flaps and ailerons.

A stretched Pantobase development of the C-123, the YC-134, has had two small fins added outboard on each horizontal stabilizer. Instead of the two wheel main landing gear and dual nose wheel of the C-123, the YC-134 has a single nose wheel the same size as the main landing wheels, which are arranged in tandem pairs on each side of the fuselage. A rocker arm system equalizes loads on the main gear in various attitudes.

More fin area was needed because of replacement of the 2,500 hp. Pratt & Whitney R2800 engines of the C-123 with Wright R3350 turbo-compound engines developing 3,500 hp. Stroukoff found the weight penalty less with the two small fins than with an addition to the already large main fin.

Two Continental-built Aspin 2 turbofans developing 400 eshp. each draw air in through louvres in the trailing edge of the wing when the inboard flaps are down.

This forestalls flow separation and makes use of the propeller slipstream for an air supply.

Flow System

Air is blown out through a similar system when the outboard flaps are down, and over the ailerons, which are drooped to become flaperons.

Forty degree droop is possible with the ailerons, compared with the maximum 60 deg. available in the flaps. The system, in effect, spreads the slipstream over the entire span.

Stroukoff said the system doubles the lift coefficient of the wing. This can mean doubling the aircraft's weight, operating from high altitude fields, or making possible a 40% reduction in takeoff run or 30% on landing run. Normal empty weight takeoff run is 438 ft.

Use of the ducted fan systems, which are independent and cannot crossfeed in emergency, means there is little temperature problem except to provide expansion joints in the skin required because of air compression, and a saving in weight. The turbofans are mounted transversely in the wing.

However, in the YC-134A, the next phase in the development, Stroukoff will replace this system with an all-suction type drawing power from a Westinghouse J30 turbojet engine. This will produce temperature and weight complications, and the exhaust will have to be discharged through the tail above the cargo door.

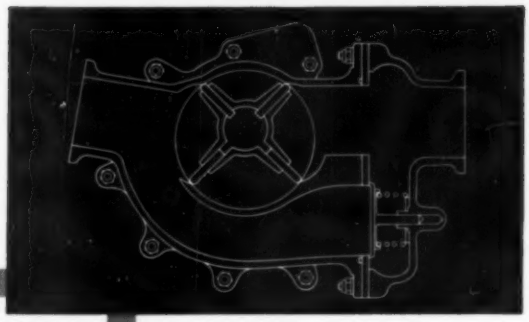
Tip Floats

Tip floats, not carried by the YC-134, will be mounted on the A model, which will have the hull sealed for sea landings using the Pantobase ski system.

The YC-134 was flown at the roll-

Model P2PM3-1 used in the Cessna T-37 jet trainer

MECHANICAL FUEL PROPORTIONERS PRODUCED BY STRATOS



Stratos Fuel Flow Proportioners* offer aircraft fuel systems designers a simple, mechanical method of fuel flow proportioning. Essentially multi-sectioned positive displacement metering devices, the Stratos Fuel Proportioners can be produced in any desired ratios. The units can be motored by the fuel flow, or driven—using electric or hydraulic motor or an air turbine.

1 C. G. CONTROL: Accurate proportioning of flow from two or more tanks maintains longitudinal and transverse stability without pilot attention.

2 SINGLE POINT REFUELING: Useful for in-flight or ground refueling. Proportioners distribute fuel in proper ratio to any number of tanks, maintaining trim at all times, whether or not tanks are topped.

3 FUEL SYSTEM SIMPLIFICATION: Cuts down on valving and plumbing—lowers system weight.

4 INCREASED OPERATIONAL RELIABILITY: Acts as booster pump in event of fuel tank booster pump failure.

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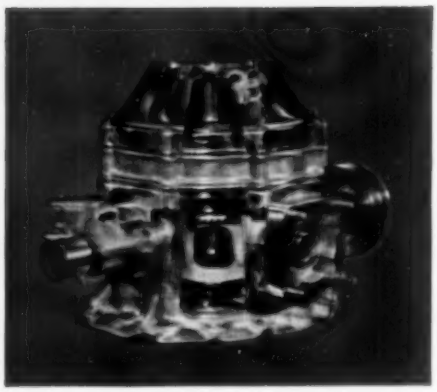
Kelsey-Hayes helps Bell put whirlwind power in the 47-G

1,800,000 cu. ft. of air per minute! That's the amazing downwash of the Bell 47-G Helicopter. Power to propel this versatile rotorcraft flows smoothly through a precision-geared transmission produced for Bell by SPECO, the Steel Products Engineering Division of Kelsey-Hayes. For over 40 years, the manufacture of precision gears and gear assemblies for aircraft has been a SPECO specialty.



Bell 47-G transmission is one of over 100 parts produced by Kelsey-Hayes for the 47-G helicopter. Other products for the aviation field include *accessory gear assemblies, actuators, computers, controls, bomb hoists, gun turrets, radar tracking and scanning assemblies, power recovery units, compressor rotors and turbine sections, blades, buckets, vanes.*

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*15 PLANTS / **Automotive:** Detroit and Jackson, Michigan; McKeesport, Pa.; Los Angeles, Calif.; Windsor, Ontario, Canada **Aviation:** Jackson, Michigan; Springfield, Ohio — 2 plants — (SPECO Aviation Division); Utica, New York — 4 plants — (Utica Aviation and Tool Division) • **Agricultural:** Davenport, Iowa (French & Hecht Farm Implement and Wheel Division)*

Bomarc Guidance Test Bed

Guidance systems for Boeing Bomarc interceptor missile will be tested by Boeing Airplane Co.'s Pilotless Aircraft Division and USAF's Air Research and Development Command in this Martin B-57 bomber, modified by Temco Aircraft Corp. to hold 17-ft. simulated Bomarc nose. In addition to strengthening the B-57, separate hydraulic and electrical systems were added for the guidance system and ammonia and nitrogen tanks were installed for cooling and pressurizing missile nose. Airborne tests will be made at Air Force Missile Test Center, Patrick AFB, Fla. The B-57 required major weight, stress revisions, and special ground equipment.

out, but the boundary layer system was not demonstrated. Stroukoff said that it would not be tried until the airplane has flown 6 hr.

After flight tests are completed, the YC-134 will be flown to Bimidji, Minn., where its Pantobase ski will be compared with standard skis on the Lockheed C-130 Hercules in snow landings.

News Digest

Third North American F-107 supersonic fighter made its first flight at Edwards AFB, Calif., last week flown by company pilot Al White. All three F-107 prototypes are now flying at Edwards.

McDonnell Aircraft Corp. will build F-101B Voodoo two seat all-weather interceptors for the Air Defense Command under a $150 million USAF contract. First test flight of supersonic interceptor powered by two Pratt & Whitney J57 engines will be made next year. McDonnell backlog now is $800 million.

Britain's aircraft sales helped push total British sales to the U.S. to higher levels. Through October, British aircraft sales totaled $37.8 million in the U.S., behind Scotch whisky ($50.1 million), but ahead of automobiles ($33.6 million).

Cessna Aircraft Co. will supply 90 L-19 observation planes to France, beginning in February. Two contracts represent first direct sales of L-19s to a foreign government.

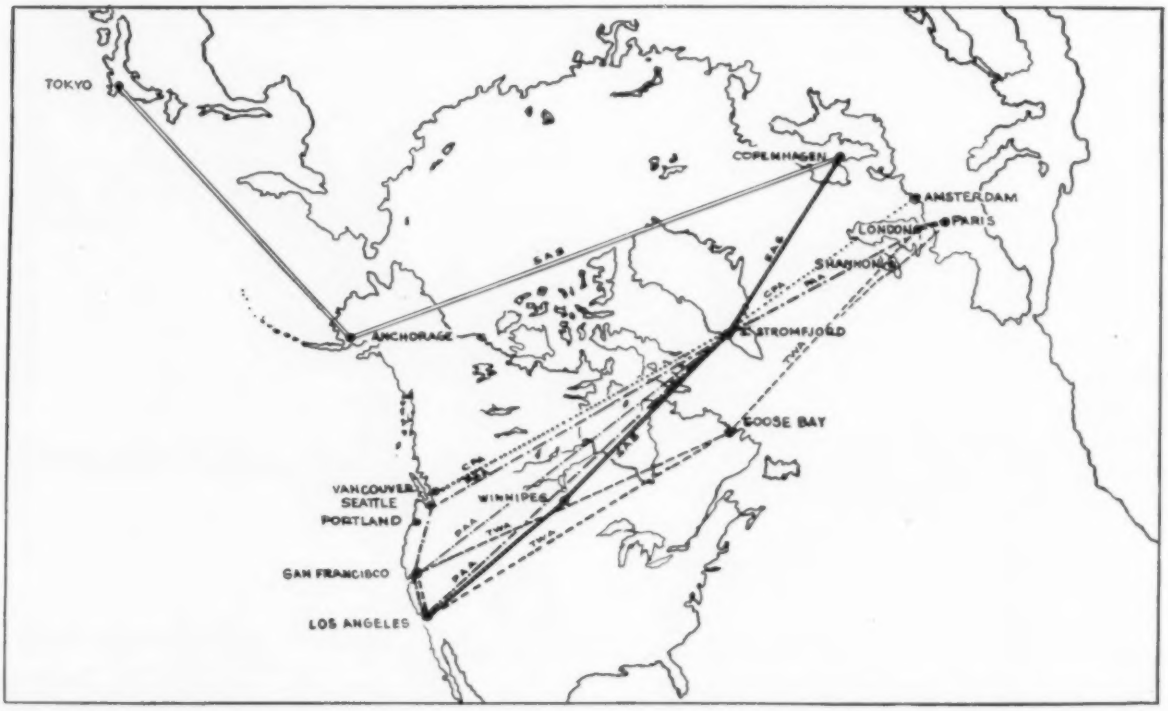
Convair Division has established preflight training program at Ft. Worth, Tex., plant for USAF pilots and observers who will test and evaluate B-58 Hustler.

Lockheed C-130 Hercules flew 735 statute-miles from Ardmore, Okla., to Marietta, Ga., in 1 hr. 44 min. Tail winds at 27,000 ft. altitude brought ground speeds over 500 mph. during some parts of flight. Average speed was 423 mph.

ACF Industries earned $3.7 million in first half of its fiscal year, compared with $3.8 million last year. Earnings per share of $3.06 this year compared with $3.05 last year, and sales were $129 million this year and $117 million last year.

USAF T-29 navigation trainers will be repaired by Lockheed Aircraft Service-International at its New York International Airport base facility under $1,260,000 contract that has recently been awarded by USAF.

Canadair's first CL-28 maritime reconnaissance aircraft, a piston engine version of the Britannia airliner, will be completed by year-end. First flight trials have been scheduled to begin in April 1957.



POLAR ROUTE outlook for next year supposes four airlines flying direct schedules between West Coast of North America and Europe. Scandinavian Airlines System and Canadian Pacific Airlines already operate polar service. Pan American World Airways and Trans World Airways service from U. S. West Coast has been recommended by Civil Aeronautics Board examiner. SAS expects to inaugurate flights from Copenhagen to Tokyo via Anchorage early next year.

Polar Route Shows Market Potential

CAB examiner, recommending Pan American and TWA, estimates 79,000 passengers yearly.

By Glenn Garrison

New York—Brisk business over the West Coast-Europe polar route pioneered by Scandinavian Airlines System seems in prospect next year as two American carriers await final approval to enter an estimated 79,000-passenger annual market.

Pan American World Airways and Trans World Airlines applications to serve the route still need Civil Aeronautics Board and Presidential approval, but the CAB examiner and all participants in the case agree the market is there.

Not even the transcontinental carriers whose traffic would be diverted by the awards oppose the basic grant of the route to Pan American and TWA.

Two other foreign-flag airlines, British Overseas Airways Corp. and Lufthansa, already have authority to serve the route whenever they choose, but at present they have not made any definite plans.

Another carrier taking the high road around the East Coast gateways to Europe—Canadian Pacific—has operated from Vancouver, B. C., to Amsterdam since June 1955.

At present CPA uses DC-6Bs in the service but plans to introduce Britannias next year.

Faith in Project

SAS first flew the direct California-Copenhagen route experimentally with a DC-6B in late 1952, using the newly developed Polarpath gyro for Arctic navigation.

Since inaugurating scheduled polar-route service from Los Angeles two years ago, the Scandinavian carrier has flown about 20,000 passengers and more than 425,000 lb. of cargo.

That the airline's faith in its polar project was justified is indicated by an overall load factor for the two years of 73%, highest on SAS's international routes. Flights were booked solid during February-August 1956. Though prepared for an initial financial loss while developing the route, SAS reported profits after the first few months of operation.

Daily Flights

Frequencies were increased from two flights weekly at the start to daily flights in each direction last summer, now reduced to five a week for the off season. Longer-range DC-7Cs replaced DC-6Bs on the route last October and SAS eliminated a stop at Winnipeg, landing only at Bluie West 8 (Sondre Stromfjord), Greenland, to refuel.

(Fueling difficulties at Bluie West recently have caused a shift back to Winnipeg. Four of the weekly flights now stop at the Canadian city for fuel only. The fifth makes a revenue stop at Bluie West.)

SAS flies its DC-7Cs in mixed configurations and reports an even division between first-class and tourist business. Average ticket sold, according to Warren E. Kraemer, vice president-traffic

and sales, has grossed about $1,000.

An exception to the combination aircraft will be a first-class service once a week scheduled to begin Jan. 1. It will replace one of the mixed flights, Kraemer says, to fill a demand that has developed for an all-luxury service out of Los Angeles.

Traffic Increase

During its third year of polar route operation, Kraemer predicts, SAS will experience a 70% increase in traffic.

Pan American and TWA are equally optimistic about 1957 prospects on the polar route, and the examiner agrees. Pan American estimates it could earn $11,330,000 in gross revenues, with a net of $2,325,000 in operating income, by carrying 23,650 passengers during the year. TWA's estimate for the year ending June 30, 1958, is $13,669,000 gross and $1,249,000 in net operating income from carrying 29,960 transatlantic passengers and 6,500 additional inter-European passengers on polar route schedules.

The American carriers expect air cargo to bring in a substantial part of the polar route revenues: $860,000 in Pan American's estimate, $297,000 in TWA's.

Pan American proposes an initial five DC-7C roundtrips weekly to London, to be increased to seven in the summer and possibly split then between London and Paris. Three flights then would be routed Los Angeles-San Francisco-Europe, three routed San Francisco-Los Angeles-Europe, and one routed San Francisco-Portland-Seattle-Europe. The CAB examiner has recommended against the Portland service, however, and Pan American has filed an exception. All flights initially would refuel at Sondre Stromfjord, but eastbound non-stops would be expected eventually.

TWA would fly nine weekly summer roundtrips with 1649A aircraft. Five flights would serve Los Angeles and four would serve San Francisco, with one of the San Francisco schedules also serving Seattle and one of the Los Angeles flights also serving Portland. The Portland and Seattle stops have been eliminated in the examiner's recommendation, however, which TWA expected. TWA's European terminals for the service would be London and Paris. Initially, a fueling stop would be made at Goose Bay.

Prospect of such heavy competition on the polar route it developed doesn't alarm SAS, according to Kraemer. He foresees plenty of business for everybody.

With national promotion by the American carriers, Kraemer feels the market can grow indefinitely. In addition to the natural advantages of the route in saving miles and time and avoidance of the congested New York gateway, the SAS executive stresses the glamor of the polar service as a major drawing card.

TERRAIN is photographed from eastbound SAS airliner an hour out of Sondre Stromfjord.

The fact that business and pleasure travelers alike go out of their way to enjoy the adventurous aspects of polar flying is illustrated, Kraemer points out, by the fact that the New York area is the third largest market for the service. SAS also sells Eastern travelers tickets to Europe from New York with return trips via the polar route to Los Angeles and thence by transcontinental airline to New York —or the other way round.

SAS has devoted considerable promotional effort to the adventurous aspects of the new route, and Kraemer feels that even with a big increase in polar schedules, it will take a long time for the route to lose this aura.

Examiner's Estimate

The CAB examiner's report sizes up the market from a more prosaic standpoint, noting that transatlantic travel to and from the West Coast increased 95% between 1953 and 1955 while total transatlantic travel increased only 28%. It cites the typical growth of population, industry and commerce in Western areas during recent years and finds that 79,000 passengers for Fiscal 1957-58 is a "reasonable market to anticipate . . ."

Lack of opposition to the Pan American and TWA applications was noted by the examiner as an "unusual aspect" of the case. United Air Lines estimated it would lose over $1 million a year in diverted revenues, but objected only to the Seattle and Portland services and to the addition of the West Coast cities as additional Pan American transatlantic co-terminals instead of a separate group of co-terminals. (Separate designation is recommended by the examiner.)

Northwest Airlines calculated its loss at $188,000 annually, but objected only to inclusion of Seattle and Portland in the polar route awards. American Airlines opposed only the additional co-terminal request.

While allowance was made by the examiner for entry of BOAC and Lufthansa into the polar route market, it appears unlikely that either carrier will pick up its option soon. The British airline says it does intend to fly a polar route, but as yet has no definite plans or estimate of when it might begin such service.

BOAC presently is busy with plans for DC-7C London-New York-San Francisco service; which will connect with Qantas at the California point.

Lufthansa may serve Los Angeles or San Francisco when it gets its 1649A equipment, expected in October 1957. On the other hand, it may put the planes on the South Atlantic or other runs. If it does serve California, the airline says, it won't necessarily fly the direct route to Europe.

The German carrier, incidentally, has its doubts about the enduring glamor of the route.

SAS, meanwhile, is getting ready to pioneer another polar route, Copenhagen to Tokyo with a stop at Anchorage. Scheduled for inauguration early next year, the service will start with two mixed roundtrips weekly in each direction.

Kraemer believes that this route might become more important than the U. S.-Europe polar service, finding most of its market in business and official travel.

New Standards to Meet Jet Needs Demanded by Airport Operators

By L. L. Doty

Washington—The Airport Operators Council has called for a high-level government research and development group to establish airport standards and requirements for jet transport operations.

In a three and one-half hour presentation to President Eisenhower's Aviation Facilities Planning Group, headed by Edward Curtis, airport operators complained they were "struggling" with design criteria developed by the Civil Aeronautics Administration before 1950, which fails to reflect airport needs for jets.

The council charged that no airport research program exists either within the government or under government sponsorship, although active research is conducted in almost every other aviation field.

What Council Wants

Specifically, the council asked for:

- **Research program** that will determine parallel runway requirements, high-speed turn-off configurations, proper lighting and marking facilities, warm-up pads, by-pass areas and service area configurations and fuel storage and fueling procedures. Attempts to obtain such information from the CAA in recent years have been unsuccessful, the council said.
- **Economic and technical forecasts** to serve as a guide for large-scale airport planning. Such planning probably will entail heavy financing projects based on 20- to 30-year bonds.
- **Nation-wide master airport plan** with government cooperation in selecting airport sites and supervising joint civil and military use of airports.

Procedure Standardization

In asking for a centralized research and development group, the council recognized that manufacturers will be required to provide information on new aircraft development before optimum runways can be planned. The council also urged standardization of airline procedures and techniques to permit long-range planning of service and terminal facilities.

Comments from manufacturers and airlines on Civil Aeronautics Board Draft Release 56-20 covering proposed regulations for turbine aircraft—which are due Jan. 15—may bring to light more exacting information on future airport requirements. Airlines now are applying technical and economic data on jet aircraft, provided by the Aircraft Industries Assn., to airline routes and projected schedules for presentation to the CAB.

However, airport operators fear jet operating restrictions proposed by the draft release may call for runways of impractical lengths if the airlines are to realize full payload benefits under certain conditions. For example, the proposed rules could reduce payloads 10 tons on the Lockheed Electra and 25 to 30 tons on the Boeing 707 or Douglas DC-8 under hot weather conditions, according to the council.

Furthermore, the council is concerned that the CAB move will nullify the special conditions for jet transports worked out by CAA with airlines and manufacturers. They were developed to "assure equivalent safety and the absence of unsafe design features" under authority granted to CAA by Civil Air Regulation 4B.10. All information on runway requirements for jet transports provided by manufacturers so far is based on the CAA special conditions project, the council claimed.

Forecasts 'Piecemeal'

Technical and economic forecasts are too "piecemeal" to be of any help to airport operators, the council said. It asked for a master plan developed by "an independent objective group" to show estimated passenger and cargo traffic growths on a five year basis together with the number aircraft of all types expected in the future.

The council said available analyses and forecasts are made by special groups for "self-serving interests." There is no central source from which a consolidation and evaluation of this information can be drawn, it added.

Better forecasts on scheduling and peak loads in order to arrive at maximum airport capacity also are needed, according to the council.

"We would like to know from some central authoritative source what maximum acceptance rate we are supposed to be shooting for at our airports," the council said.

The council accused designers and manufacturers of building aircraft with "little or no regard for the support facilities required to keep them operating."

It said both military and civil groups have expected ground and air environment to become adjusted to each new aircraft development, and it warned "the time is fast approaching when aircraft development must be integrated with support services development."

Airport Location

Airport sponsors are seeking some guide in the location of airports by regions and areas, based on anticipated needs of both civil and military aviation segments, the council said. It called for cooperation by private, public, commercial and military agencies in planning airports in high density areas and accused the CAA of failing to discharge its responsibility in setting standards for minimum separation distances between airports, location of holding and approach patterns and helicopter operations.

The council tackled the question of the relationship of federal and local responsibility of airport operation and reiterated its stand that traffic control from ramp to ramp should be exercised by the federal government.

Financial responsibility of installation and maintenance of approach lights should be charged to the federal government since such aids are a part of the federal airways, in the council's opinion. Runway and taxi lights, however, are the joint responsibility of the federal government and the local airport operator, the council said.

Southwest Pushes Name Change

Washington—Southwest Airways is moving ahead with plans to change its name to Pacific Air Lines in spite of roadblocks put up by the Civil Aeronautics Board.

Southwest has asked the Board to reissue its permanent operating certificate in the name of Pacific Air Lines. Last month, the CAB denied the airline permission to use the Pacific name in an interim program it planned to educate the public on the switch from Southwest Airways to Pacific Air Lines.

Supporting its petition for a permanent name change, Southwest argues that the new name would better describe the West Coast area it serves and that it would be easier to promote. The carrier also feels that the new name would be more salable to the traveling public and would aid in traffic development and reduction of subsidy.

The decision to make the switch was made in June when Southwest's stockholders approved the move. The new name was to become effective on Jan. 1, and an interim transition program was planned in which both names would be used.

Use of the name Pacific Air Lines along with the company's present name requires CAB approval, so Southwest asked permission in July to use the Pacific name until Jan. 1 when the

switch would be finally complete.

In November, the CAB denied the requested authority on the grounds that the new name would create "substantial public confusion" because nine other airlines have names which include the word Pacific.

The Board received various objections to Southwest's plan from Pacific Northern Airlines, South Pacific Air Lines, Pacific Air Freight and Pacific Southwest Airlines

No Confusion

Southwest denies there would be any substantial public confusion involved in the change and asks that the Board change the carrier's name permanently. Since the CAB took four months to act on the July application, the interim program is a dead letter.

The local airline points out that advertising budgets and plans must be made in advance, and that its program for 1957 has already been built around the Pacific Air Lines name.

Also, because of the uncertain situation, the carrier has not been repainting its aircraft when they have gone through overhaul in recent weeks, and several aircraft are operating without any business marking at all.

New Name Needed

Southwest says it has had the name change in mind for several years. The carrier believes the traveling public associates the Southwest name with the multi-stop, short-hop service provided when the airline first started flying. The theory is that a new name would give Southwest a fresh start in coaxing highway travelers into the air.

The carrier asked the Board for expedited treatment of its application so the change can be effected by Jan. 1. In its petition, Southwest said the CAB has authority to approve the change without a public hearing if it wants to.

New York Airways Hires Negro Copilot

New York—New York Airways has hired Perry H. Young, a Negro, as a pilot for the carrier's scheduled helicopter services. Young qualified initially as copilot in NYA's new S-58s.

According to the Urban League of Greater New York, Young is the first Negro to be employed as a flight crewman by a United States scheduled passenger airline.

Young had applied to become a pilot with the helicopter airway some time ago, but his application was rejected on the ground of lack of experience. When a new CAA ruling made copilots mandatory on S-58s, New York Airways then hired Young as a copilot. He will train to become a first pilot.

AIRLINE OBSERVER

► Decision to adopt penalty feature of the No-Show Plan probably will be approved at the Jan. 15 meeting of the Air Traffic Conference. Most airlines feel that some drastic plan must be given a trial if Civil Aeronautics Board pressure for action on the no-show problem is to be relieved. However, many airline officials doubt the proposed ruling will increase revenues. They say the penalty will merely translate present no-shows into cancellations, and that the number of seats actually lost because of no-shows will not be reduced enough to produce revenue gains. Some observers privately fear many passengers will be unfairly penalized because the volume of incoming telephone calls that already are clogging some airline switchboards may often prevent a passenger from canceling his space without delay.

► **Civil Aeronautics Administration has set Jan. 13 as the target date for upgrading air traffic controllers entitled to a pay boost under the revised grade structure approved early this fall by the Civil Service Commission (AW Oct. 1, p. 41).**

► Zero-fuel weight of the Fokker Friendship F-27 turboprop transport has been increased from 31,210 lb. to 32,210 lb. and maximum landing weight has been raised by 250 lb. to 34,000 lb. without changing estimated 3,000-ft. landing runway length requirements of the aircraft.

► **Canadian Air Lines Pilots Assn. has called for the establishment of a stand-by emergency civil reserve air fleet similar to the reserve fleet organized by U. S. airlines several years ago. Canadian pilots argue such a fleet would have expedited DEW Line airlift operations and could have been used to move United Nations troops into the Suez area.**

► Eastern Air Lines is launching an intensified promotional campaign throughout the newly acquired Colonial Division territory in a move to expand its Florida vacation markets.

► **Air transportation has a labor force that is "younger, better educated and more personable" than most industries, according to a survey recently conducted by the Labor Department's Bureau of Employment Security. From the survey, which covered 85% of the 134,000 persons employed by the industry, the bureau concluded that rigid qualifications established for airline jobs create recruitment problems. Most critical shortages are in mechanic and pilot job categories, but the survey revealed scattered shortages of ticket agents, hostesses, cargo handlers, electricians and sheet metal workers.**

► United Airlines will use pre-loaded cargo containers on its DC-8s but will reserve two of the aircraft's cargo pits for manually loaded cargo. The decision is the result of tests conducted by United with the DC-8 mock-up using regular cargo, mail and baggage of varying weights and volumes. Tests demonstrated that five pre-loaded containers can be loaded or unloaded in seven minutes with the airline's present ramp equipment.

► **Airlines have been unsuccessful in developing a universal interline reservations message form that is adaptable to all types of electronic reservations systems being introduced by the airlines. Representatives of Teleregister, Remington Rand and International Business Machines have been in close touch with the airlines in a move to develop more compatability in equipment to prevent any delay in progress toward full automation of reservations procedures.**

► Three fire-fighting systems proved successful in recent tests conducted by American, TWA and United Airlines in cooperation with the City of Chicago. Foamite, carbon dioxide and fog-type extinguishers proved equally effective in extinguishing fire set to mock aircraft filled with rags, excelsior and wood soaked in oil and gasoline at Midway Airport. New fire-proof suits permitted firefighters to enter blazing structure.

► **Airline travel on North Atlantic routes increased about 20% this year. Traffic experts are crediting the new off-season excursion and immigrant fares for a major improvement in the North Atlantic traffic picture.**

BEA's Viscount 802s

Production line of Vickers Viscount 800 series being turned out for British European Airways at Vickers' Weybridge plant. First of 24 Viscount 802s ordered by BEA was accepted last month at Wisley airfield in ceremony in which Lady Douglas of Kirtleside, wife of the chairman of BEA, broke a bottle of champagne over the nose of the airplane. Fourteen Viscount 806s also are on order by BEA.

Satisfied With Proteus Icing Fix, BOAC Reschedules Britannia Start

London—Anti-icing modifications on Bristol Britannia engines have been pronounced satisfactory by BOAC and the much delayed four engined turboprop will enter service between London and Johannesburg on Feb. 1.

An urgent modification program was undertaken by Bristol, BOAC, the Ministry of Supply and Ministry of Civil Aviation after Britannia developed icing troubles during route proving trials last summer.

"Modifications made by the Bristol Aeroplane Co. to prevent icing troubles which occurred in the engines of the Britannia under certain atmospheric conditions have been fully tested and found satisfactory by that company and by BOAC," the airline said.

Bristol said two major fixes have been made to prevent flameouts caused when lumps of dry ice crystals accumulated in air intakes and passed into the combustion chambers. These are:

- **Use of glow plugs** in the flame tubes to ensure continuity of combustion.
- **Modification of intake ducts** to alter airflow characteristics so that accumulation of dry ice is prevented.

Bristol said the modifications are being made to all Proteus engines delivered to BOAC and will be standard in future powerplants. To solve the Britannia difficulties, one of the most intensive research programs since the Comet crashes was undertaken by Bristol and government research organizations, including the Royal Aircraft Establishment and the National Gas Turbine Establishment.

BOAC said Britannia service between London and Australia will begin in March, with the turboprop being introduced on routes to Hong Kong, Japan, Aden, Ceylon and Singapore in late 1957.

Negotiations by Northeast Airlines for the purchase of five Britannia 305s were delayed until Northeast was satisfied the problem had been licked (AW Dec. 10, p. 41).

BEA Air Freight Revenue Climbs

London—British European Airways estimates its revenue from air freight operations will exceed its earnings from air mail for the first time this year, making it the biggest air freight carrier in Europe.

BEA now operates over 80 all freight services weekly, flying more than 60 short tons of freight daily. The airline reports its air freight business has expanded by more than 25% over last year. Air freight earnings for 1956 are expected to top $4.2 million dollars, an increase of $1.4 million in the past two years.

BEA says it plans to introduce a special express air freight version of the new Viscount 800, which is due to enter passenger service early next year.

RCAF Main Cog In UN Airlift

Abu Suweir, Egypt—United Nations emergency forces in Egypt are being supported by a daily airlift of Fairchild C-119 aircraft operating into this advanced UN base along a narrow Egyptian air corridor.

Major airlift support is supplied by a Royal Canadian Air Force Squadron flying under United Nation colors. Italian C-119s also are bringing in some supplies.

Urgency of the operation can be assessed from the fact that when flights recently were cut off for two days by weather over the Mediterranean, food ration of the 3,000-man UN force dropped to less than one day's supply.

The C-119 flights of the RCAF, which brings in both cargo and troops, operate from the UN staging area at Capodichino Air Field, Naples, Italy. Douglas C-124 Globemasters and Lockheed Super Constellations of the U.S. Navy and Air Force carry supplies and personnel to Naples. Initial UN airlift into Egypt was provided by Swissair DC-6Bs until the arrival of the Canadian C-119 squadron.

Although this Egyptian air force base which is serving as temporary UN advanced headquarters was hard-hit by the Anglo-French attack, the runways escaped serious damage. A number of hangars were burned out and in the center of the airfield a scrap pile of Russian MiGs gives the lie to Egyptian claims that only wooden dummys were damaged.

Abu Suweir lies at the edge of the desert only a few miles west of Ismailia and the Suez Canal. It is less than 15 minutes flying time south of the ceasefire line at El Cap, which marked the southernmost point of the Anglo-French advance.

Flight path lies from Naples to the island of Crete, where a refueling stop is made at Soudha Bay. Air traffic control at Crete is under the direction of a U.S. Navy crew aboard an LST anchored there for the purpose. The American unit provides radio communications, homing devices and PI approach control. Both Italian and Canadian air crews are high in their praise of the Navy group.

SHORTLINES

▶ **Airlines Clearing House** transacted interline business worth $66,215,738 in October, an increase of 23.5% over the previous October.

▶ **Allegheny Airlines** flew 5,431,000 passenger-miles in November, a 29% increase over traffic of November 1955. The carrier's passenger traffic registered a 17% increase in the first 11 months of this year.

▶ **American Air Export and Import Co.** has begun air express service on its New York-Atlanta-New Orleans route and expects to expand the service to 12 other cities early next year.

▶ **Capital Airlines** has added a seventh non-stop Viscount flight between Washington and Chicago to its winter schedules. The airline now has 51 Viscounts in service.

▶ **Flying Tiger Line's** board of directors has voted a 5% common stock dividend payable Jan. 15 to stockholders of record on Dec. 15.

▶ **Lake Central Airlines** will issue $300,000 in new securities to raise capital for development of new Lima-Toledo-Detroit and Youngstown-Erie-Buffalo routes recently granted by the Civil Aeronautics Board.

▶ **Mohawk Airlines** carried 33,551 passengers in November, 26.6% more than the airline carried in the same month last year. Cargo traffic increased 35.9% in the same period.

▶ **Piedmont Airlines** has signed a three-year contract for turbine fuel with Shell Oil Co. Shell will supply fuel for Piedmont's fleet of Fairchild F-27s when the aircraft begin scheduled service in early 1958.

▶ **Southern Airways** flew 16,500 passengers 2,825,000 passenger-miles in November for increases of 19.6% in passengers and 22.4% in passenger miles over November 1955.

▶ **United Air Lines** flew 322,935,000 passenger-miles and 4,575,000 freight ton-miles in November for gains of 17% and 77% respectively over traffic in the previous November.

▶ **West Coast Airlines** has negotiated an 18-month contract with the Air Line Agents Assn. covering passenger service employes. The agreement provides for pay increases ranging up to $30 a month, uniform allowances and various other benefits.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

The Jet Crew

About ten years ago a third member was added to the crew of airline aircraft weighing 80,000 lb. This added member was needed primarily for flight operational considerations, although some airlines chose to install mechanic personnel in these jobs. The coming of airline jet and turboprop aircraft of greatly increased size and speed poses somewhat of a problem under existing conditions. (For a flight engineer viewpoint, see letter page 94.)

In the two man airplane I fly today, there is often need of additional help for communications, traffic control procedures and general flight duties. A mechanic would be dead weight.

As speeds increase in the next few years and area traffic becomes more congested, this need will also increase.

ALPA Stand

During its November convention the Air Line Pilots Assn. took a firm stand against flying the new jet equipment without a third pilot aboard. Some airlines have already provided for this—others may soon find it necessary since CAR contemplates the presence of two qualified pilots at the controls at all times (on jets), a requirement which cannot be met without a three pilot crew.

Obviously jet transports, as the Boeing 707, do away with such things as prop and mixture controls. Cruise control is a function of piloting skill and experience, governed principally by choice of route and altitude selection.

These aircraft are equipped largely with automatic systems which must be monitored and shut off or operated at reduced power when malfunctioning occurs.

Very little opportunity exists, if any, for the use of specialized mechanical skills in flight.

Experience and Training

Actually, the Air Force operates eight engine B-52s and six engine B-47s with a two pilot crew. Many Air Force people admit however, that if they had the continual schedule, traffic control and operational problems of the airlines they would undoubtedly use at least a three pilot crew.

In the operation of jet aircraft and accessory systems, all indications are that experience and training requirements must be high and must flow on an equal basis through all crew positions in order to meet the all important "fail-safe" requirement. In other words each member of the operating crew must speak the same language and understand the relationship of his duty and each part of the aircraft to the overall question of safety in flight.

Additional Problems

The additional problems of radar monitoring, fuel consumption and their relationship to flight planning and weather, faster closing speeds etc. make it clear that skills in the cockpit must be pilot skills available and usable 100% of the time.

CAR obviously confers complete authority over all crew member duties and aircraft operations to the pilot in command. A typical manual of an airline states, "No propeller will be feathered, no cabin supercharger disconnected, no discharge of CO_2 made, or any emergency procedure initiated without explicit orders from the pilot in command." To carry out his job effectively the Captain must have the proper assistants.

Pan American Proposed for Circle Route

By Craig Lewis

Washington—A Pacific Great Circle Route between California and Japan was recommended for Pan American World Airways last week by Civil Aeronautics Board Examiner William F. Cusick.

The new Pacific route would offer stiff competition to Northwest Airlines for traffic to the Orient, but it would not provide the disasterous competition that PanAm could supply if allowed to fly to Tokyo from Seattle, Northwest's gateway to the Orient.

Under Examiner Cusick's recommendation, Pan American would provide direct service to Japan from Los Angeles and San Francisco, as well as through its present Central Pacific route via Honolulu. Northwest would continue to have a monopoly on Japan-bound traffic traveling through the Seattle and Portland gateways.

The report represents a victory for Pan American in its historic fight for a Great Circle Route to the Orient. But it falls short of the carrier's desire to operate the route out of all four West Coast gateways.

While the report represents a partial defeat for Northwest and its efforts to deny Pan American any Great Circle rights, the carrier's main concern is to keep Pan American off the Seattle-Tokyo route. The report supports Northwest's stand on this issue.

Cusick recommended that Pan American be permitted to operate a nonstop service between co-terminals Los Angeles and San Francisco and Tokyo. Operational stops would be permitted at any point along the route.

The examiner found that the new authority should be temporary and should expire April 10, 1962. Since Northwest Airlines' present Seattle-Tokyo authority expires at the same time, the CAB would have the opportunity to review both routes at the same time.

The question of Great Circle authority for Pan American is involved in the reopened Trans-Pacific Renewal Case. The rest of the case was decided in 1955, but President Eisenhower deferred a decision on the Great Circle issue. Then last January he asked the CAB to bring the record up to date on the specific question of Pan American's Great Circle application.

The old record in the Trans-Pacific case contains information on the situation to the end of 1952. The examiner's report now deals with new developments since the old record was made. These fresh developments include substantial traffic growth in the Pacific area, availability of new transports, mail routings and the improved economic health of Pan American and Northwest.

Airline traffic across the Pacific has grown substantially in the last four years. The report shows that in 1952 transpacific air traffic totaled 26,715 passengers. By 1955 this traffic had grown to more than 51,800 passengers, and the examiner thinks that could possibly reach the 72,000 passenger mark estimated by Pan American for the year ending August 31, 1957.

Added to this increased passenger business is the fact that the Defense Department shifted military mail to commercial carriers, giving Northwest and Pan American approximately $6.5 million in extra income every year. These increases have removed both carriers from subsidy for their Pacific operations. In 1952, the two required a total of $12.7 million in subsidy.

Mail routings are an issue in the case because the Post Office Department has shifted the postal concentration center from San Francisco to Seattle, and Northwest is carrying most of the mail traffic. Pan American argues it should be certificated out of Seattle to give it an equal opportunity for mail traffic, but the examiner rejects this argument and observes that Pan American would have resisted certification of Northwest out of San Francisco when the postal concentration was in the California city.

Much of the argument for Great Circle authority centers around the advent of the DC-7C with its long-range capabilities. Pan American has assigned eight of its 33 DC-7Cs to Pacific duty, and Northwest and Japan Air Lines also will fly them over the Pacific.

The hearings developed a great deal of controversy over the nonstop capability of the DC-7C, and the examiner observes that the new transport is not capable of operating a reliable nonstop service between Seattle and Tokyo, the shortest routing, with an economic payload. Pan American will have to plan a fueling stop, probably at Shemya, if it operates the California-Tokyo service.

Airlines Improve Safety Record

Washington—Safety record of the scheduled airlines for 1956 shows an improvement over the previous year's record despite the collision of two airliners over Grand Canyon in June.

The Civil Aeronautics Administration, in a report of 1956 civil air activities, announced today that the domestic scheduled airline fatality rate per 100 million miles declined to an estimated 0.62 from 0.76 in 1955. A total of 143 persons were killed in four accidents during the period as compared with 156 in seven accidents during 1955. The CAA statistics do not include the Nov. 1, 1955, accident at Longmont, Colo., in which 39 persons were killed because of sabotage.

There were no fatalities on either international scheduled airlines or irregular carriers. The irregular group has operated an estimated 1.4 billion passenger-miles domestically and internationally without a fatal accident since November 1955.

Total number of passengers carried by all scheduled airlines registered an 11% increase to an estimated 45,860,000 from 41,441,000 in 1955.

Domestic passengers during the year totaled 41,868,000 and international passengers carried by U.S. scheduled airlines climbed 17% from 3,415,000 in 1955 to an estimated 3,992,000 in 1956. Total revenue passenger-miles rose from 24.2 in 1955 to an estimated 27.4 billion this year.

Most spectacular rise reported was in the number of civil aircraft manufactured and the number of pilot certificates issued. Aircraft manufactured during the year reached 7,200 as compared with 4,280 in 1955 representing a 49% increase. Airline transport pilot certificates issued during the year totaled 4,000 for a 43% increase, while commercial pilot certificates jumped from 13,029 in 1955 to 19,000, a 46% increase.

The report disclosed a 1% rise in private pilot certificates issued, or 17,791 in 1955 to 18,000 in 1956, and an 8% increase in student pilot certificates—from 44,354 to 48,000. Mechanic licenses issued totaled 9,000 this year as compared with 6,288 issued last year.

For the first time in CAA history, the number of applications for CAA approval of jet engines moved ahead of piston engine projects by a margin of 21 to 18. Aircraft certifications handled during the year included 14 different U.S. and foreign turbine-powered aircraft and 14 helicopters.

The report showed a total of 65,250 civil aircraft in operation during the year as compared with 60,432 in 1955. Scheduled transport aircraft totaled 1,690 against 1,497 last year. Express and freight ton-miles on domestic scheduled airlines increased by 12%, from 316 million to 355 million. Cargo ton-miles on international carriers climbed from 110 million last year to 125 million this year for a 14% increase.

Northeast's Britannia Turboprop

Northeast Airlines markings are shown on Bristol Britannia which Northeast has ordered for use on its New York-Miami run. Northeast order was for five Britannia 305s which will carry 92 first-class passengers or 133 passengers in tourist service. Northeast plans a 3 hr. 15 min. New York-Miami flying time with the Proteus-powered turboprop airliner (AW Dec. 10, p. 41).

Airlines Delay Ground Equipment Plans

By L. L. Doty

Washington—Airlines have postponed indefinitely any industry-wide decision on the best ground equipment for jet transport operations, although some agreement has been reached in establishing basic requirements for jet line maintenance facilities.

The decision to defer consideration of new ground equipment was reached in a summary of the joint meeting of the Ground Equipment and Maintenance Facilities Subcommittees of the Air Transport Assn. held this fall in Miami (AW Oct. 2, p. 82).

Technical Conclusions

Conclusions drawn by the two subcommittees after listening to 24 technical papers presented by aircraft manufacturers, airlines and equipment companies during the four day session include:

- **Prototype ground equipment** must be put to practical test before any conclusions can be reached on the types needed. Plans also were made to hold a second joint meeting on the West Coast within the next six months to test equipment with the Boeing 707 (AW Dec. 3, p. 43).
- **Subcommittees need better** monitoring and more screening of papers presented by equipment manufacturers in order to obtain a comprehensive survey of the market by eliminating unnecessary background and sales pitches. Subcommittee members felt that condensed reports would give them a clearer picture of their ground-equipment needs.
- **Development of standards** and designs for ground equipment and jet engine overhaul and test facilities at the present would be premature because of the rapid progress being made in these fields.

Hangar Needs

The need for larger hangars and more hangar space was emphasized in a summary of line maintenance requirements set forth by five airlines during the Miami meeting. It was generally agreed that basic hangar planning will require a minimum design of 150-ft. wide and 150-ft. deep with a 50-ft. truss clearance.

Trans World Air Lines pointed out that the jets will create many problems in hangar depth and height, some of them impossible to correct because of limitations imposed by adjoining buildings. TWA said its operation is primarily a nose-in-hangar operation that could be handled by increasing the depth of the hangar.

One system TWA employs when faced with a rudder height problem is to deflate the main gear struts of an aircraft while inflating the nose gear strut. Maintenance is performed with the aircraft in this attitude.

Trans Canada Air Lines is contemplating a hangar with an unobstructed area 150-ft. deep and 817-ft. long. United Air Lines' hangar is planned with outside dimensions of 460-ft. by 360-ft. The building will be a "double cantilever" type hangar with a center core section 80-ft. in depth.

The Boeing 707 will require hangar doors designed to open to a span of 130 ft. American Airlines favors rolling doors and suggests that the use of tail-fin pockets in the doors may be required. United intends to use electrically-operated, horizontal sliding doors with a clear height of 50-ft.

TWA plans doors of glass and steel construction that will be equipped with personnel and vehicle entrances. TCA will install overhead, electrically operated doors built in five sections which operate in unison.

Floor Requirements

Hangar flooring will be stronger. Pan American World Airways will pour concrete for an allowable load of 300,000 lb. United's floors will be reinforced concrete with a monolithic topping. Floors will be sloped slightly to eliminate any traction problems for tow vehicles.

American, Pan American, TCA and United will use radiant floor heating. Chief advantages, they say, are rapid drying of wet floors, easier deicing of aircraft and hangar door tracks. Disadvantages, include employe complaints of hot underfooting and a slowness in cooling hangars when doors are opened.

Trans World Air Lines will heat hangars with steam unit heaters equipped with blowers. Distribution of

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Soviet Jet Pilot

First Pilot Alexandr Bystritski sits at controls of Soviet Tu-104 jet transport used on Trans-Siberian route. Formation stick is at left. Pilot wears throat microphone, has oxygen mask, apparently for emergency use, clipped to coat.

heat to offices and special areas will be handled by ducting.

Engine work stands used by American on DC-7, DC-6 and Convair aircraft will be suitable for the Lockheed Electra.

The Boeing 707, however, will require redesigned stands because of the shape of the engines and their height from the ground.

American does not expect to install permanent docks for wing and fuselage maintenance of the 707 since relatively few field maintenance operations in this area are anticipated. Now tail stands will be required since present work stands are only 30 ft. high. The 707 tail is 40-ft. in height.

Scaffolding Needs

Pan American leans towards portable scaffolding, platforms and stands and probably will not install fixed dock facilities. Trans Canada pointed out that stands are not needed for Viscount engine maintenance since the engines are slung low enough to permit work from floor level.

TWA hopes to develop a universal stand that is adaptable to all jet aircraft. United plans to employ the portable type of work stand.

Noise will dictate the location of most engine run-up areas. American said blast fences may be essential in some areas and suggested the possibility of ground noise suppressors for all run-up operations.

Pan American suggested the use of

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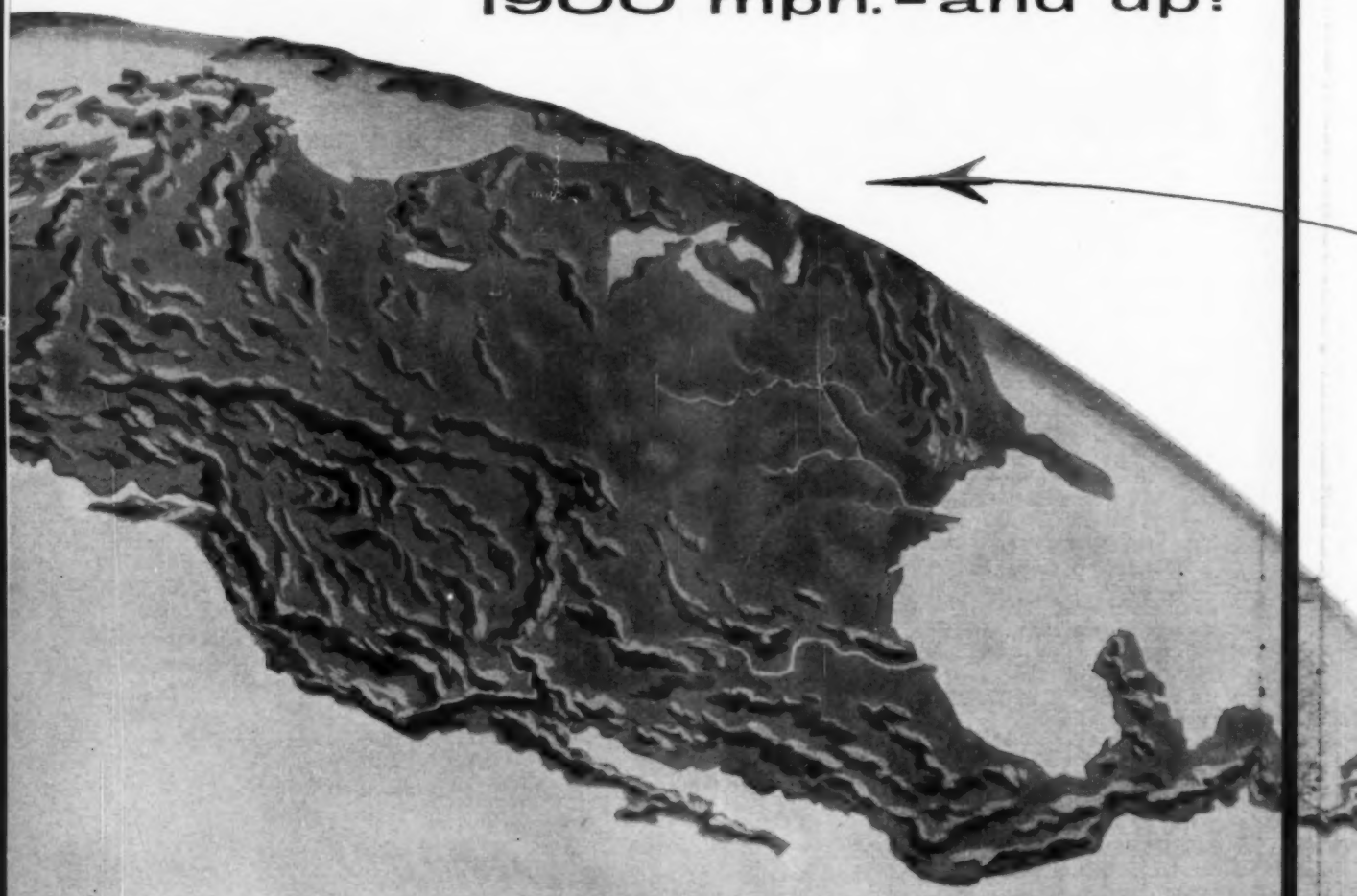

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concrete run-up pads 150-ft. by 175-ft. Trans Canada has found that blast fences 12-ft. high provide reasonable noise and blast suppression for the Viscounts.

TWA plans an 8x10-ft. blast fence and said its construction department is now experimenting on a concrete wall for noise suppression characteristics. The pad will be concrete with rubber-asphalt type expansion joints. United intends to pave its run-up area with concrete, sealing the joints with buna rubber compound to counteract effects of fuel spillage. The airline will use noise suppressors but plans to locate the run-up area in a remote section of its plot where no blast fences will be required.

Engine intake screens may be used by the airlines to prevent engine ingestion of foreign matter.

CAB Discusses West Coast Tour

Washington—Civil Aeronautics Board members who toured West Coast jet transport manufacturing plants earlier this month (AW Dec. 10, p. 31) have endorsed the jet transports now under development by major U.S. aircraft companies.

The four CAB members who visited Boeing Airplane Co., Douglas Aircraft Co., Lockheed Aircraft Corp. and Convair Division of General Dynamics were all enthusiastic over their flight in the Boeing 707 and their discussions with the engineers and economists working on the four companies' jet projects.

Future Visits

The Board plans to visit Fairchild Engine and Airplane Corp. for discussions on the F-27 turboprop and the M-185 jet executive transport. James R. Durfee, CAB chairman, said the Board plans to fly in all the new turbine transport types.

The CAB chairman said he recognized the need for early action on new turbine transport certification rules and revealed that the Board is asking for a substantial increase in its budget for Fiscal 1958 to handle the heavy work load that is developing with the advent of jet transports. Most of the extra money will go to increase the staff of the Bureau of Safety Regulation.

Observing that development of jets brings new and revolutionary problems to the CAB, Durfee said present certification rules "will obviously require considerable revision."

He acknowledged that any delay in certification, either through revision of the rules or otherwise, would be a matter of tremendous concern to the manufacturers, the airlines and the public. He said he is confident that the CAB will have its safety rules for "adequate protection of the public" ready in time for certification.

Economy of Electra

Durfee also repeated an observation he made in Los Angeles that the Lockheed Electra holds the greatest promise for economy on shorter routes in the jet era.

He told AVIATION WEEK that his observation on the Electra was based upon a comparision of the economic data presented to the Board by each of the four manufacturers visited. With this information as a basis, Durfee said he is impressed with the relative economic advantages of the Electra on the shorter routes.

CAB Vice Chairman Joseph P. Adams thinks a major feature of the new jets will be the bigger, more spacious cabins and the freedom from noise, vibration and turbulence. He said a passenger feels as if he is "wrapped in a cocoon of comfort."

Adams feels that the jet transport will bring a new era of passenger acceptance of air transportation and that higher speeds mean more passenger appeal. He thinks the jets will operate economically from the date of introduction.

Survey Shows Many Shy of Air Travel

Three fourths of American adults have never traveled by air, and fear of flying probably helped keep the majority of them on the ground, according to the Survey Research Center of the University of Michigan.

Seventy-six percent of the respondents in the center's 1955 National Travel Market Survey who had ever traveled by any means listed general fear of flying as a drawback. Fear of air sickness specifically was the third-ranking disadvantage, listed by 8% of the adults surveyed.

In its findings of the survey, the center reported 75% of the respond-

BOEING 707 jet transport prototype, which flew four members of the Civil Aeronautics Board from Seattle to Los Angeles, stands on ramp at Los Angeles International Airport. Return trip flight to Seattle was made in 1 hr. 50 min. time.

ends had never taken a trip by air, 51% had never taken a bus trip, 30% had never gone by rail, and 11% had never taken an automobile trip. Sixteen percent had flown at some time, but only 7% had flown within the past year.

Speed of flying was cited by 86% of those respondents who had ever taken a trip by any kind of carrier as an advantage of air travel, with 8% reporting themselves as air-minded: "love planes, thrill of flight." Third-ranking advantage of air was its cost, with 6% listing air travel as cheap, cheaper or reasonable.

The survey was supported financially by the Port of New York Authority and the New York Central Railroad. Others selected findings released by the center:

• **Two-thirds of all trips** by adults in the United States are for pleasure or on vacations (the report distinguishes "pleasure" trips from visits with friends or relatives).

• Of the adult population, 60% take one or more trips a year, but 40% never get as far as 100 mi. from home.

• **Three out of four** people from families with $15,000 or higher incomes have taken an air trip at some time. Only one in ten in the below $3,000 group has traveled by air. Proportion of those who flew during the past year is 1-2% in below $3,000 group income, 3-4% in $3,000-4,999 income, 6-12% in $5,000-$9,000 income, 20-50% in over $10,000 income. Only 7% of the respondents are in the $10,000 or over bracket, however, so the lesser income group accounts for about half of all air trips.

• **Other disadvantages** of flying mentioned by respondents: bad health, poor connections, inconvenient terminals, "don't see the scenery."

• **Other advantages:** safety, comfort, cleanliness, meals, good connections.

Twenty-two percent of the respondents who had flown cited roughness as unpleasant recollections.

San Francisco Airport To Expand for Jets

Expansion of San Francisco International Airport to handle jet age traffic was assured as San Francisco voters passed a $25 million bond issue to finance a 10-year improvement program.

Included in the project:

• **Extension and strengthening** of runways.

• **Construction** of additional concourses —some of which may reach so far from the main terminal that a satellite terminal may have to be built.

• **Development** of sites for maintenance facilities.

• **Addition** of a heliport and executive aircraft facilities.

The first $6 million phase, programmed for the next two years, calls for extensions which will lengthen the present 8,750-ft. north-south runway to 9,500 ft.

Helicopter Taxi to Serve San Francisco

San Francisco—Rick Helicopters, Inc, has inaugurated helicopter taxi service in the San Francisco Bay area.

Initially Rick assigned two float equipped Bell 47 helicopters to the service.

If demand warrants, up to 23 other helicopters will be added. They will carry two passengers and the pilot, plus 40 lb. of luggage per passenger.

Downtown San Francisco landing area will be the Ferry Building heliport. Rick is making arrangements for additional landing sites in downtown Oakland and other Bay Area communities. The helicopter will deliver a passenger to his door if his yard gets Civil Aeronautics Administration approval as a landing area. Rick expects main pickup points to be San Francisco, Oakland, and the airports that serve the two cities.

Rates will be based on the firm's $75

MERRY CHRISTMAS AND A HAPPY NEW YEAR

Temco sends its warmest holiday greetings to you and to our friends everywhere by giving to the Air Force, Army and Navy relief societies the funds normally spent on Christmas cards.

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NEW

CALIDYNE model 174 SHAKER

1500 lbs. force output

a basic shaker for 6 different Vibration Test Systems

SYSTEM NUMBER	1 174/203	2 174/184	3 174/80	4 174/186	5 174/186	6 174/80
Type	Sinusoidal	Sinusoidal	Sinusoidal*	Sinusoidal*	Random or Sinusoidal	Random or Sinusoidal
Power Supply	Electronic	Rotary	Electronic	Electronic	Electronic	Electronic
Force Output	1250 lbs.	1300 lbs.	1500 lbs.	1500 lbs.	1300 lbs.	1500 lbs.
Frequency Range	5-3500 cps.	5-2000 cps.	5-3500 cps.	5-3500 cps.	5-3500 cps.	5-3500 cps.
Max. Load 10 g.	105 lbs.	130 lbs.	130 lbs.	130 lbs.	130 lbs.	130 lbs.
Max. Load 20 g.	42.5 lbs.	55 lbs.	55 lbs.	55 lbs.	55 lbs.	55 lbs.

*Also adaptable for Random Vibration Testing.

CALIDYNE'S Model 174 Shaker featuring high frequency operation and low input requirements has been so designed that it can be utilized in any one of six CALIDYNE Vibration Test Systems.

The versatility of the Model 174 Shaker extends the range of vibration testing for which this shaker can be used. It further advances CALIDYNE Systems of vibration control, enabling equipment manufacturers to: create vibratory forces over a wide range, measure them, use them for testing and measuring the test results.

Typical vibration testing applications of these Model 174 CALIDYNE Shakers include.

1. **Brute force** shaking at frequencies simulating the worst conditions of ultimate operation.
2. **Structural response** to determine mode shape, frequency and damping characteristics.
3. **Fatigue testing** for high stress providing deflections far greater than normal usage.
4. **Random** vibration testing for more exact simulation of true environment.

For further information call (Boston) Winchester 6-3810.

THE CALIDYNE COMPANY

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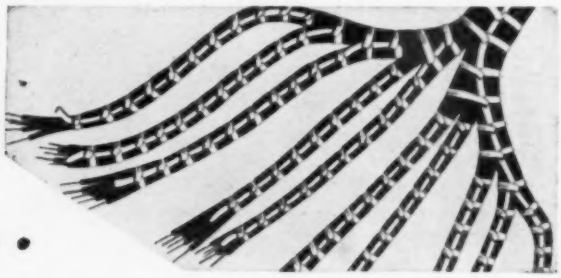

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New Ben-Har Braided Lacing and Winding Tape combines two superior insulation materials—DuPont Teflon and glass fibers. Fibers are Teflon coated before braiding to maintain rough texture and assure tight knots—and to eliminate abrasive action of the glass. Ben-Har Tapes will not shrink and cut through insulated wires. They are pliable from −100°F. to 500°F. They are non-absorbent and inert to most known chemicals and oils . . . completely wax-free and fungus proof.

Available in 3/64, 1/16, 3/32 and 1/4 inch widths, in Offwhite. Also available in 8 colors and Black on special order. Write for prices and samples.

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*T.M. Owens-Corning

per flight hour charge for charter service.

From the Ferry Building to San Francisco International Airport—an 11-minute trip—will cost $7.50 per passenger.

Jackson Hughes, Rick's chief pilot, said the taxi service will not be a money-making proposition because return trips often will be made with no passengers on board.

Main reason for offering the service, he explained, is to promote interest in helicopter travel. Rick hopes to arouse enough demand in the area for scheduled helicopter service to nudge its Civil Aeronautics Board application to the hearing stage.

Rick applied five years ago for permission to operate scheduled helicopter service within a 200-mi radius of San Francisco, but no hearing has been held yet.

Rick would need a government subsidy to operate this proposed helicopter service.

The new taxi service is first such operation in the Bay area.

It will be based at San Francisco International Airport, where Rick is headquartered.

Lease-Purchase Plan Offered to Airlines

Aircraft rental with options to purchase will be offered to airlines on an expanded basis by Standard Factors Corporation, a national commercial finance company.

Standard Factors, which has provided some purchase-leaseback financing of planes on an experimental basis since early 1955, includes a trade-in arrangement through which airlines may replace older equipment.

Under the trade-in plan, Standard Factors will apply the value of the older planes to the cost of new equipment provided under the lease-purchase agreement.

The older equipment will then be sold to secondary airlines on a pay-as-you-go basis.

The firm reports a total of 14 new and used commercial air transports financed to date through lease-purchase arrangements with airlines. Two basic formulas have been used in setting option prices.

Under one formula, a fixed percentage of the rentals is applied to the purchase or option price, with the balance of rental payments retained by Standard Factors.

The other plan, designed for longer term leases, calls for higher purchase prices during the early years of the lease, with option prices lessening as loans are paid off and carrying charges diminish.

Helicopters Lift Stranded Lightplanes

Ft. Rucker, Ala.—A new helicopter lift technique to speed reclamation of stranded light aircraft from remote areas has been perfected at the U. S. Army Aviation Center here. The system has applications in training and combat.

Designed by engineers of the Continental Army Command's Board 6 and built by Hayes Aircraft Corp., of Birmingham, Ala., key to the system is a tubular steel frame that is quickly fastened to the roof of an L-19 cockpit, providing a lift point that insures proper balance.

Thus far, the work has been done with the exterior sling on a Sikorsky H-34 helicopter. However, the device can be used with any helicopter of sufficient capacity, such as the Sikorsky H-37A, Vertol H-21C or a flying crane.

Benefits of Technique

Col. Robert R. Williams, Board 6 president, points out that a forced landing in an inaccessible field by a student lightplane pilot can create a major problem if the plane cannot be flown back to base. In one case, it required two days of work to salvage such an aircraft, and about $2,000 worth of damage was done getting the plane free of the terrain.

In the short time that the Aviation Center has been testing the new technique it has been put to good use.

In one case, an L-19 made a forced landing on a sand spit on the Gulf of Mexico. A takeoff could have been attempted, but an engine change was necessary. The H-34 brought the aircraft home for repairs.

In another instance, a Bell H-13 helicopter en route to Ft. Rucker from the factory in Dallas was forced down by an engine failure about 51 mi. west of New Orleans. It was impossible to change the engine at the scene. Disassembly of the aircraft was prevented by picking it up with an H-34 and moving it 20 mi. to the nearest airport. The engine was changed, and the H-13 continued its trip.

Economy

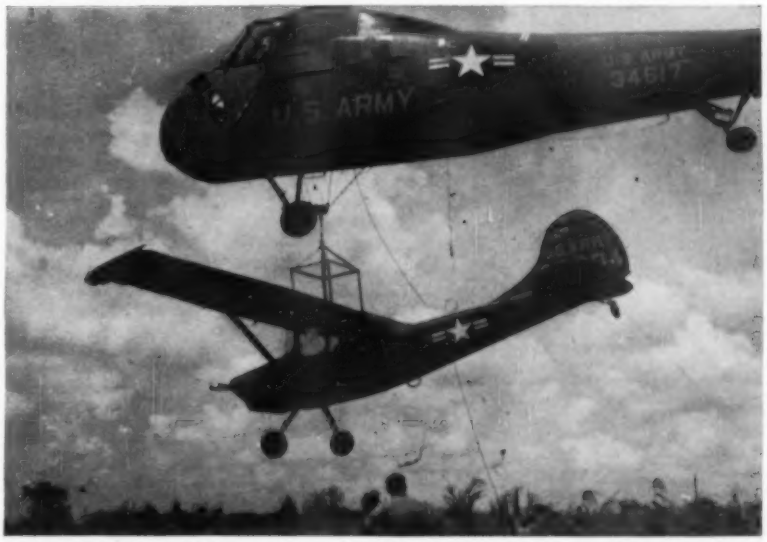
Col. Williams emphasizes the economies realized in using the helicopter to recover disabled aircraft.

It frees repair crews from long and tough jobs, prevents further damage to the plane and speeds its return to operational service.

In combat, the same savings can be realized at a time when they are more critical.

Salvage teams always are a drain on the manpower of a unit in the field and sometimes provide a vulnerable target for the enemy.

TUBULAR steel frame from Sikorsky H-34 is attached to L-19 observation plane.



HELICOPTER lifts L-19 clear of ground (top) and flies off (below), gaining altitude.

Three Autopilots Will Guide Vanguard

By Philip J. Klass

New York—Project Vanguard (earth satellite) vehicle will employ eight separate control systems to provide pitch, yaw and roll stabilization during different phases of its flight. The guidance control systems were described here recently at a meeting of the American Institute of Electrical Engineers by Peter A. Freeman, Project Vanguard controls group engineer for Glenn L. Martin Co.

To save weight, the Vanguard vehicle uses no controllable fins. Instead guidance is achieved by deflecting the thrust axis of the first and second stage rocket motors during powered flight.

While this approach permits more payload, it complicates the guidance-control system designer's task, Freeman said.

System Division

Three of the control systems will be used to provide pitch, yaw and roll axis stabilization of the first stage. Three other systems will take over after first-stage separation to control the second and third stages.

The remaining two control systems will come into use during the coasting phase after second stage burn-out but before separation from the third stage, Freeman reported.

The eight control systems, being developed by Vickers (division of Sperry Rand Corp.) will obtain pitch, yaw and roll axis displacement signals from a gyro stabilized platform developed by Minneapolis-Honeywell. (AW Sept. 24, p. 27.)

Linear and Non-Linear

Martin will use both linear and non-linear ("bang-bang") type control systems in Vanguard. Pitch and yaw axis stabilization, which must be held to close tolerances (approximately one-half degree), will be accomplished by vacuum tube or magnetic amplifiers powering hydraulic actuators which in turn displace the rocket motor and its thrust line.

This applies to both the first and second stage (before burn-out) control systems.

Roll axis stabilization of the first and second stages will use non-linear on-off control systems to operate a pair of small jets whose thrust is provided by turbo pump exhaust. The less complex "bang-bang" type control can be used because the roll axis need be stabilized only to within about three degrees, Freeman said.

Also, because the thrust jets are essentially on-off type devices without proportional control, there is no need to provide the more complex and sophisticated linear control system, Freeman added.

After second-stage burn-out, the rocket motor can no longer be used for stabilization. During the coasting period (prior to dropping the second stage), two pairs of thrust jets are used, one pair each to provide pitch and yaw axis control moments. These also are operated from on-off type control systems.

The third stage, containing the satellite, has no stabilization control systems. It relies upon gyroscopic moments established when it is spun about its roll axis just prior to separation from the second stage.

This is the same type of stabilization that is imparted to a shell by muzzle rifling.

Tough Control Problems

The Vanguard vehicle stabilization problem is complicated by the fact that 90% of the gross weight (fuel) is unloaded during the flight, radically changing the center of gravity and moment of inertia, Freeman pointed out. Other control problems arise because the vehicle's structural rigidity is reduced to a minimum to permit maximum useful payload.

This results in structural bending and vibration. If this structural resonance corresponds to the natural frequency of the control system, it can destroy the vehicle.

Structural resonance proved a serious problem on the Martin Viking rockets, and the 72-foot Vanguard vehicle is even more susceptible because of its greater fineness ratio (length divided by diameter).

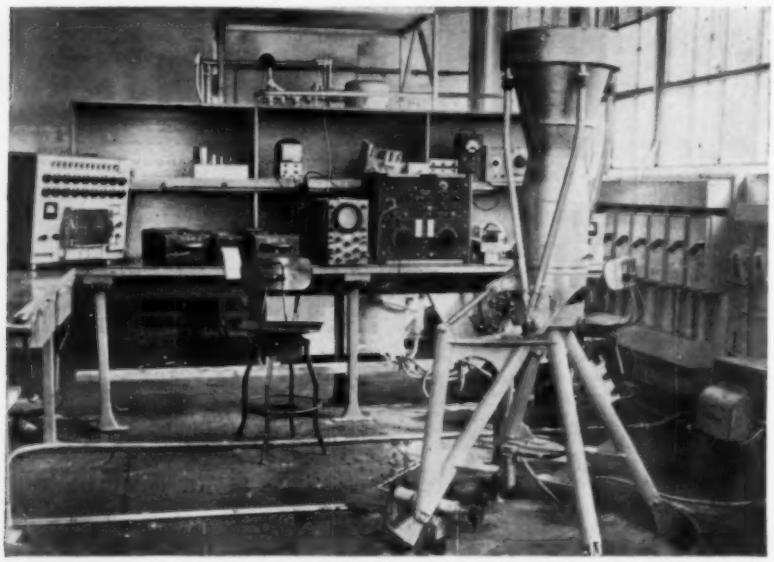
Another problem arises because of the high intensity acoustical feedback of noise from the rocket engines. Unless this audio feedback is suitably filtered, it can produce resonance in the structure and the control system, Freeman said.

Martin has selected a displacement-rate type control system for the Vanguard linear (pitch, yaw) controls, with rate being derived from an R-C network.

Two Types of Amplifiers

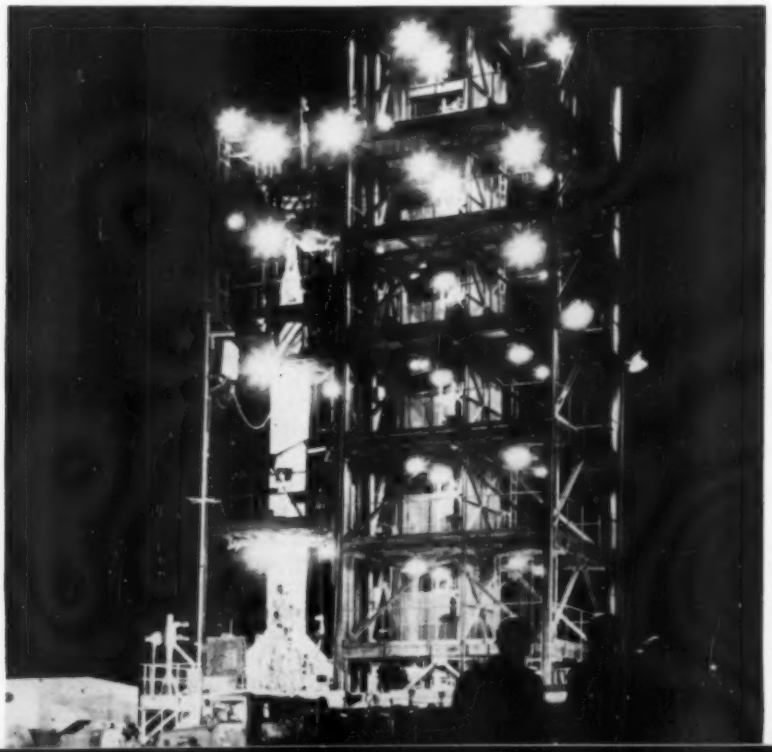
Martin is having both vacuum tube and magnetic servo amplifiers developed to provide a backstop in the event one proves unsuitable. Freeman said that the magnetic amplifier may prove lighter, but the vacuum tube version is more flexible in its capabilities.

The M-H stabilized platform will use HIG (integrating) gyros. These floated gyros are extremely rugged and accurate, both important requisites for



DYNAMIC mock-up of first-stage Vanguard autopilot, which uses hydraulic actuators to displace rocket engine, enables Martin engineers to test system response.

MODIFIED Viking rocket, illuminated alongside platform (below), is fired (above) in first round in Vanguard satellite test program. Viking reached height of 125 mi., traveled 180 mi. out into Atlantic Ocean from firing site at Cape Canaveral, Fla. Platform was moved back before firing. Second round in test program will begin next month (AW Dec. 10, p. 23). Viking is built by Glenn L. Martin Co.



operation of the Vanguard vehicle.

The HIG gyro also has a torque motor which enables it to be precessed at any desired rate.

Critical Phase

This is useful in two ways. First it permits programming of the Vanguard vehicle's pitch axis attitude to give it the desired flight path and orbit. Secondly, it permits the gyros to be aligned prior to launching—a difficult and time-consuming operation for the required accuracy—after which the gyros can be corrected for apparent drift caused by the earth's rotation by introducing a signal which precesses the gyro sufficiently to compensate for such rotational effect.

The most critical phase of the entire operation will come during the coasting phase after second stage burn-out, Freeman said.

At this time the vehicle must be stabilized with a pitch accuracy of better than one-half degree. This means that the gyro stabilized platform must be aligned to the horizontal with considerably greater accuracy.

Any gyro drift which has occurred during the first and second stage flight will appear as a stabilized platform error, which is the accumulated total (integral) of gyro drift from the time of launch.

Boeing Takes Second Bomarc Site Option

Boeing Airplane Co. has taken an option on a second tract in the San Francisco Bay area as the possible building site for a pilotless aircraft production plant.

Both tracts, the second in the San Ramon valley near Parks AFB, and the first, a Ford Motor Co. plant at Richmond, Calif., would be used in a program involving the USAF supersonic guided missile, Bomarc. Neither option has been exercised, and the decisions hinge on favorable zoning and arrangements for utilities and rail transportation.

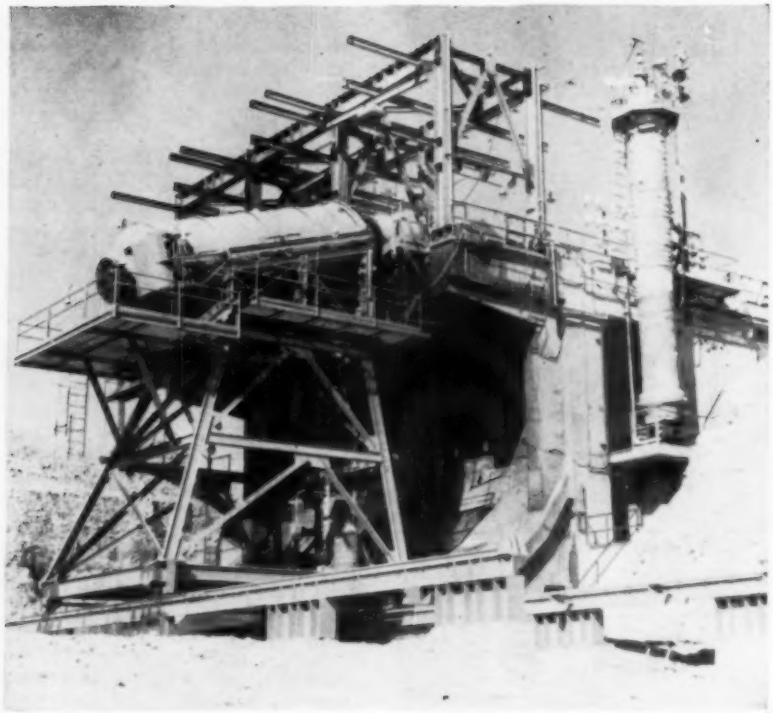
Boeing's Bomarc contract is for the complete weapon system.

Testing Completed for Martin TM-61 Matador

Final testing of Martin's TM-61 Matador missile is complete at the Air Force Missile Test Center, Patrick Air Force Base, Fla.

Matador thus has become USAF's first tactical missile in operational status.

Two units trained at Patrick, the 1st and 69th Tactical Missile Squadrons, are the first to be equipped with the Matador.



Aerojet Sacramento Test Stands

Air Force ballistic missiles program will result in substantially increased production at Sacramento, Calif., plant of Aerojet-General Corp. The company has production contracts for liquid rocket engines for intercontinental Titan and Atlas and intermediate-range Thor missiles.

Sacramento operation—three plants on 20,000 acres—includes three position C-clamp-type test stand used in development test firings of thrust chambers and injectors (top). Each firing position has a 300,000 lb. thrust rating.

In front of the test stand can be seen large chamber used to simulate altitude conditions.

Stands in Pairs

One of larger test stands of the four complexes of test-stand pairs at the facility is shown at right. Located along a 40 ft. deep ravine, this stand is used for liquid engine firing. Test stand sizes range from 50 ft. wide × 50 ft. high × 67 ft. depth to 87 × 100 × 82 ft.

Four control buildings house instrumentation for operation of two of the test stands, and the stands and control buildings are connected by tunnels. Instrumentation is comprised of equipment for gathering low frequency, medium frequency, high frequency data and timing equipment:

• **Low frequency equipment** has 104 channels available. Static and quasi-static information is recorded on tape, converted and tabulated.

• **Medium frequency** equipment—192 channels of pressure, force, valve position can be reduced.

• **High frequency equipment.** Data is recorded by tape and cathode-ray recording oscillograph on 24 channels.

• **Timing sequences** on 96 channels are measured on chronographs and recorded by printout units.

Each test stand has three firing positions to fully instrument each test; switching system transfers recording equipment. Time required for this transfer is about 45 min. on normal tests. Reduced data is available 30 min. after normal firing. Analog and datatron digital computers are used and an IBM 704 unit is being installed.

Cold flow test facilities of the Liquid rocket plant are used for components. Pump test equipment includes electric drive equipment delivering 2,250 hp. at 30,000 rpm.

Liquid oxygen is to be supplied by mobile plant in the test area, and a liquified gas plant is under construction by Air Products Co. on USAF contract. Liquid plant currently uses 700,000 gal. of water a day and 1,285,200 kwh. per month.

Construction Program

This construction is part of the substantial program underway. It includes additional test stands, which the company is building with its own funds, and a $13 million, 300,000 sq. ft. production plant which will be started soon under an Air Force contract.

Existing buildings include an administration and engineering building, the liquid rocket plant, and a solid propellant plant which has produced 500,000-900,000 lb. of propellant per month since production began in 1952 on a Navy contract.

Hiring of 1,100 more employes is contemplated for the new production plant. At present, the Sacramento plant employs about 3,500.

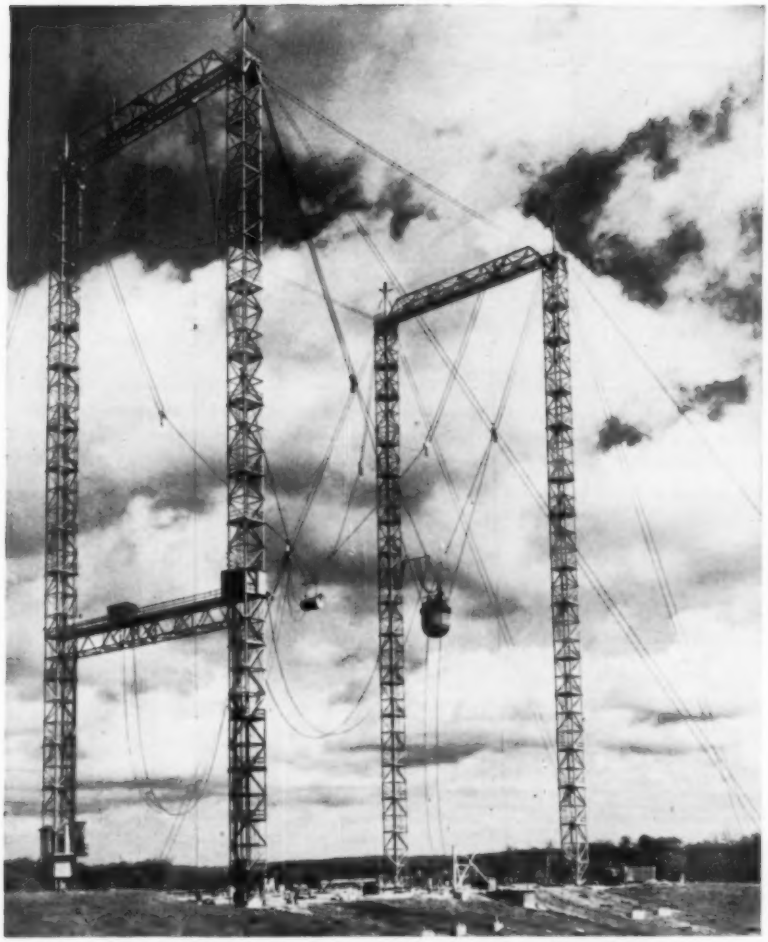
Rocket Quality Fuel Made From Ammonia

Anhydrous hydrazine of rocket fuel quality has been produced from ammonia on a laboratory scale in a gas phase chemical reaction carried out in a high-frequency electrical discharge.

The process was developed and patented by Lord Manufacturing Co., Erie, Pa. Lord believes the process yield is enough to justify experimentation in a complete pilot plant. Work on the process dates back to 1944; the technique was patented two years ago.

Basically the reactant material—in this case ammonia—flows through a radio-frequency field of decreasing intensity. Zones of controlled pressure, temperature and residence time are formed and the final product is activated, formed and removed from these zones.

The company says the process is particularly suited to chemical synthesis reactions which are difficult or impossible to do under conventional techniques.



Oak Ridge Tower Shielding Facility

Four 324 ft. steel towers are used to simulate shielding conditions of an airplane in flight at the Oak Ridge National Laboratory. Facility was constructed at a cost of $2 million for Atomic Energy Commission's aircraft reactors program. Protective shielding for crew and a test reactor with its own shielding can be suspended as shown in the photograph.

Future research on the process is aimed at the production of high-energy fuels for missile powerplants, intermediates for high-temperature-resistant polymers and other high activation energy materials.

Lord Manufacturing Co. has been known for its work with vibration control mounts and bonded rubber products. This chemical synthesis work was done by the company's Central Research Staff as part of its work in related fields.

Lithium Producers Establish Institute

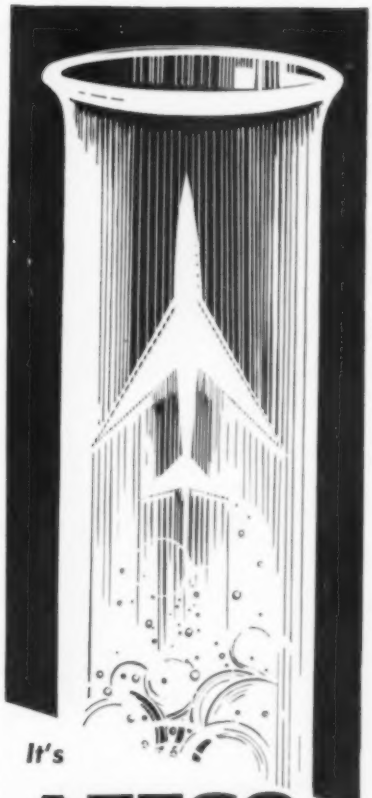
Research direction for lithium and its compounds on an industry-wide basis is the major reason behind the recent formation of the American Lithium Institute, Inc.

Three major lithium producers—American Potash and Chemical Corp., Foote Mineral Co. and Lithium Corp. of America—formed the Institute.

The Institute will act as a technical information agency and will maintain a library and literature service at its Princeton, N. J. office.

Lithium is one of the light metals used as the base for many high-performance fuels (AW Nov. 12, p. 51). Other uses of lithium include: light-metal alloys, plastic catalytic agents, and—in lithium salt form—in porcelain enamels, air conditioning and multi-purpose greases.

The Institute plans to support research and development on the problems of lithium use in chemistry, ceramics, metallurgy and nucleonics. Projects will be assigned to colleges and research institutions and will be monitored by the Technical Policy Committee composed of representatives from the three companies supporting the Institute.



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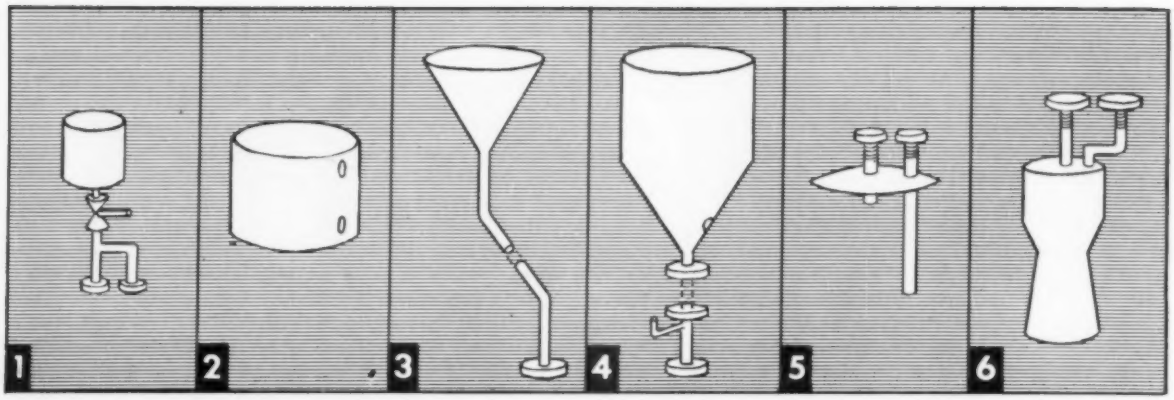
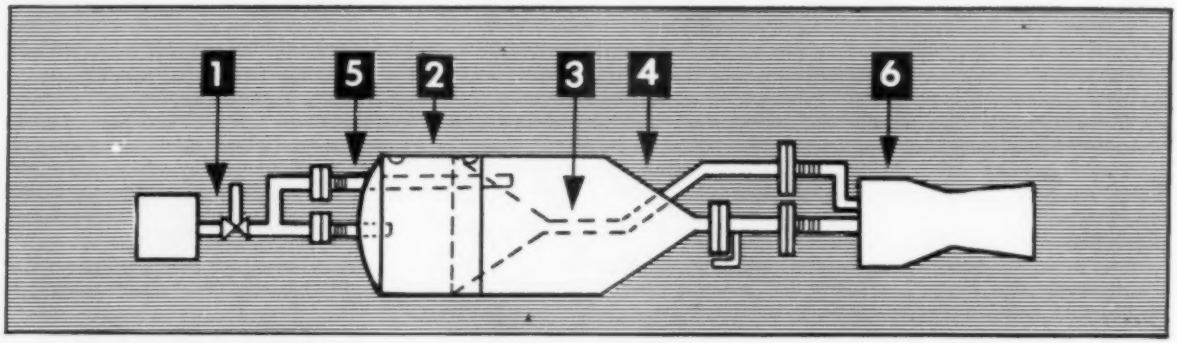


PROTOTYPE DESIGN of a modular rocket engine designed by Bell Aircraft Corp. for use in anti-aircraft missiles has six assembly units: (1) gas generator, (2) oxidizer tank section, (3) oxidizer tank funnel, (4) fuel tank, (5) oxidizer tank top, (6) thrust chamber. Units require five welding operations to form completed engine, which stresses reliability.



Modular Design Offers Missile Reliability

New York—Modular rocket powerplant components have been proposed by a Bell Aircraft Corp. engineer as a way to increase missile reliability.

Following the familiar formula which states that total missile reliability is the product of the reliabilities of the components, Guenther W. A. Haase described to the American Rocket Society here an easy-to-assemble rocket powerplant of only six units:

- **Gas generator** with three-way valve and flanged pressure lines. It would have a solid-propellant charge to pressurize the liquid propellant tanks. Though Bell reports much progress, no such solid-propellant generator has been perfected.
- **Main section** of oxidizer tank with fill ports for oxidizer and fuel.
- **Funnel section** of oxidizer tank with flanged discharge lines.
- **Fuel tank** with flanged discharge line and provision for hypergolic starting slug.

The funnel section of the tank has a hole for the oxidizer discharge line.

- **Top of oxidizer** tank with pressure lines for oxidizer and fuel tank. Both lines have bellows and flanges which connect to gas generator.
- **Uncooled thrust chamber** with ceramic lining. Haase claims it differs from normal chambers in that the injector head and chamber are welded together.

Tanks are funnel-shaped to assure high rate of flow at different accelerations. To save weight and space the smaller tank is built into the larger. Lack of differential pressure on the funnel or discharge line in the inner tank means these parts can be built of thinner material. Fill ports of both tanks can be closed by hand with a plug which is flush with the surface.

Aluminum frangible discs are used instead of valves. One is located in the discharge line and one in the pressure line of the discharge system. On the fuel side, one is in the pressure line and two are in the discharge line, between which the hypergolic slug is stored.

Various propellants could be used—for example, white fuming nitric acid and JP-4 with unsymmetrical dimethylhydrazine for hypergolic starting. Bell admits that this design is limited by thrust and burning time and at present is unable to meet missile requirements which would be effective against bombers of the next generation.

Suggested procedure for assembly:

- **First:** Oxidizer tank funnel is welded to inside of main portion of tank.
- **Second:** Top of oxidizer tank is welded to main portion.
- **Third:** This assembly is welded to fuel tank.
- **Fourth:** Thrust chamber is welded to tank assembly at flanges with frangible discs installed.
- **Fifth:** Gas generator is welded to engine assembly at flanges with frangible discs installed.

Bell reports progress in solving problems of acid-jet fuel propellant rockets and plans to stress this field. Haase emphasized the following points in explaining his powerplant design:

- **Defensive missiles** which must be ready for instant firing can use only those propellants which are stable and can be stored for a long time at varying climatic temperatures.
- **Hypergolic propellants** eliminate problems of separating starting slug from main propellant, but increase danger to launching sites.
- **Low thrust,** short burning time engines function better with pressurized tanks to feed pumps because they are simpler and more reliable. These tanks

require only the pressurizing gas and have fewer moving parts than any other developed system.

• **Reliability** of propellant feed. Tanks can be designed to meet specific acceleration problems better than snorkel tubes.

• **Elimination of valve failure** because of corrosion or lubricant solidification can be helped by substitution of frangible discs wherever possible.

Material which is expensive, scarce, or requires special machinery is avoided. For example, the thrust chamber with ceramic lining and no wall cooling is easier to mass produce than one with jacket or wall tube cooling.

According to Bell, this powerplant design is desirable for use in a weapon because it fills the requirements of a minimum of parts, mass production, and high reliability.

When to Eat, Sleep Space Flight Factor

Los Angeles—Artificial day-night cycling, a natural pattern of sleep and rest, will become a major factor in actual space flight, Dr. Hubertus Strughold, chief, Department of Space Medicine, School of Aviation Medicine, Randolph AFB, points out.

In a talk at a symposium here sponsored by the University of California's Institute of Transportation and Traffic Engineering in cooperation with the Aeronautical-Engineering Assn. and the Institute of the Aeronautical Sciences, Dr. Strughold discussed the effect of time shift related to transport by air both for conventional transport and space flight.

No natural sequence of day and night will exist in more advanced phases of space operation, he said, because the vehicle itself will be a small celestial body revolving around the rotating earth or orbiting to other celestial bodies in the gravitational field of the sun.

Inside the cabin of such a vehicle, Dr. Strughold said, where the extra-atmospheric sunlight without skylight of space creates darkness, a day-night cycle similar to the pattern of earth will have to be simulated.

Dr. Strughold made these points for current conventional air transport:

• **Period of incomplete time** adaptation must be considered in scheduling hours for the sessions of international diplomatic and economic conferences immediately after long distance flights. As a rule, during the first two days after flights that involve crossing five or more time zones, important meetings should not be scheduled in the early morning at the end of an eastbound flight, or during the late afternoon following westbound trips.

It is important to estimate these effects on the combat efficiency of airborne troops, flying crews, and staff officers flying into a theatre of war.

• **Day-night cycle** problem is especially important for the crews of international airlines. For them during a certain part of the year, a natural regular pattern of day and night does not exist, but their bodies demand a regular pattern of sleep and rest.

If their stay on another continent involves only a few days, it would seem advisable to maintain the daily cycle of the home continent. In the long run, too frequent shifts in their physiological sleep and wakefulness cycle might result in chronic fatigue and other disturbances.

• **In the transportation** of patients, for the first few days after arrival by air, a gliding adjustment of the time table for eating, sleeping and treatment is recommended.

Niobium Research

Possibility that niobium, a metal with a 4,320F melting point, may provide a break-through in high temperature metal research was suggested to the American Ordnance Association by Dr. Robert F. Mehl, Carnegie Institute of Technology. According to Dr. Mehl, a dozen laboratories are now studying this relatively new element which was formerly called columbium. Use of niobium in high-temperature alloys was also mentioned to the AOA by Dr. John B. Johnson of Wright-Patterson AFB.

Dr. Mehl made a strong plea for more fundamental studies, which he said had been neglected under the pressure to produce useful alloys. He stated that for this reason research must proceed by a sort of scientific common sense and that such research is very expensive and time-consuming.

Coupling Is Changed In GE's T58 Engine

Kerns Tri-Lobe coupling has replaced a conventional involute spline coupling in General Electric's T58 turboshaft engine drive. Two-part version of the three-part coupling is being used at 19-20,000 rpm. to take angular and some parallel misalignment between the power turbine and reduction gears in the T58.

Advantage of this type of coupling is that it can be ground down to precision finish tolerances from highly heat treated steel, according to Eugene Shipley, gear designer of General Electric.

Previous involute spline coupling, once machined, would distort upon final heat treatment. However, a special polygon grinder is needed to grind both the internal and external Tri-Lobes.

Asp and Wasp

Asp and Wasp are research vehicles for upper atmosphere studies developed for the Navy by Cooper Development Corp., Monrovia, Calif. Asp (left) was built for BuShips for ionosphere research; peak altitude is over 175,000 ft. Asp is 12 ft. long and weighs 245 lb. Wasp (right) was built for Office of Naval Research and is adapted from the Loki anti-aircraft rocket. The head separates at the end of burning and coasts to a summit altitude between 110,000 and 150,000 ft. depending on the booster. Both Asp and Wasp are powered by Grand Central solid propellant rockets.

"Tan Glove" Adds Magnetic Dimension

By Russell Hawkes

Bedford, Mass.—Overall shape and orientation of the earth's dipole magnetic field as it would be observed at an altitude of 4,000 mi. is being calculated from the position of the geomagnetic equator recently traced by the Geophysics Research Directorate of USAF's Cambridge Research Center (AW Sept. 24, 1956, p. 31).

Results of the survey, Project Tan Glove, are expected to be useful in planning and evaluating satellite programs in the International Geophysical Year 1957-1958.

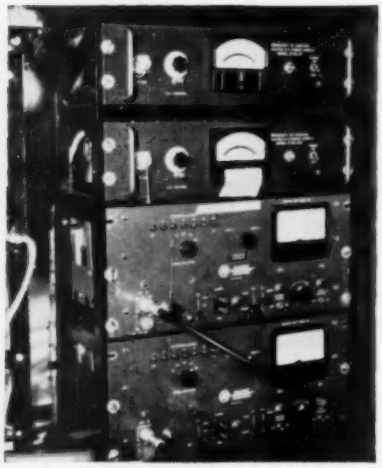
NEUTRON PILE is taken apart and lead and paraffin blocks are restacked in the KC-97. Ends of neutron counting ion tubes are visible in part of the pile in truck.

Equator Tracing

Project Tan Glove accomplished the geomagnetic equator tracing by seeking out the line of lowest cosmic ray intensity caused by magnetic deflection of the rays toward the poles. Measurement was made by a neutron pile carried around the earth by a specially equipped KC-97 borrowed from SAC following a course which zig-zagged 900 mi. to either side of the geographic equator.

A theoretical model of the field at altitude was established by Dr. John A. Simpson and Peter Meyer of the University of Chicago's Enrico Fermi Institute of Nuclear Studies. The Air Force study provided a check on the theory.

The absolute magnetic north pole indicated to the Air Force investigators is about 45 deg. of longitude west and about 2 deg. of latitude north of the theoretical pole. Both locations are closer to the geographic pole than the surface position of the magnetic pole, which is near Thule. The difference between surface position and altitude position is due to the decrease of influence with altitude of local distortions of the field.



BLACK BOXES count neutrons freed in pile by cosmic particles. Upper two are scalers. Lower two are amplifiers.

Indirect Measurement

Direct measurement of cosmic ray intensity is impossible because cosmic primaries or Alpha particles seldom penetrate the atmosphere to an altitude which can be reached by investigators. However, it is possible to measure the concentration of cosmic secondaries or Beta particles which are produced by the collision of the Alphas with the atmosphere.

The 1,500 lb. neutron pile used to measure the radiation was loaned to the Air Force by the Fermi Institute, which has placed similar neutron piles in observatories throughout the world. Readings from these fixed installations are being used as a check on study results to make sure that variations in the total influx are not confused with geographic variations.

The pile consists of a shell of lead bricks from which neutrons are freed by the impact of Beta particles, a 4½ in. thick paraffin moderator and two pairs of boron gas filled ion tubes to close the counting circuit.

A .001 in. cobalt wire runs the length of each tube.

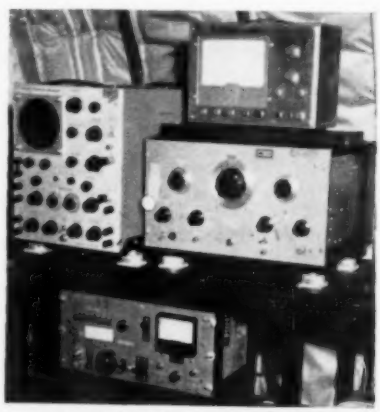
To increase the sensitivity of the tubes, each is kept partially ionized to just below the count threshold by maintaining a drop of 2,000 v. across the cobalt wire. To avoid spurious counts, voltage control is accurate within millivolts.

The counter is fired by complete ionization of the boron gas by free neutrons.

Before each leg of the trip, the pile was pre-flight checked by counting radiation from a lead-jacketed beryllium-copper neutron source. The 50,000 year half-life of the source assured a constant intensity emission by which the counter could be calibrated.

Project scientist Ludwig Katz and instrumentation scientist, John F. Butler, praised the SAC crew of the KC-97 for the precision with which they controlled the conditions of the study and for holding strictly to the schedule of the flight in spite of difficulties.

Accuracy of measurements depended



ELECTRONIC TEST equipment added to weight carried on C-97 on project. It was used to check out circuitry in the counter.

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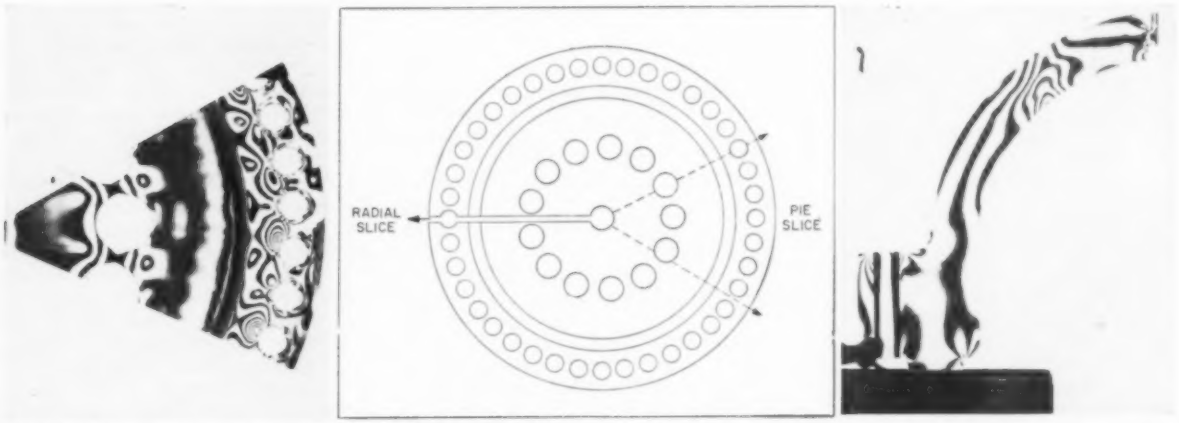
upon excellent navigating and keeping a constant atmospheric mass above the pile because this factor controls Beta intensity. Pressure altitude was chosen as a measure because it is an inverse function of atmospheric mass above the altimeter.

Precise holding of altitude was vital because neutron count varies exponentially with pressure altitude.

Katz said that a tolerance of 50 ft. would have been acceptable but that the SAC pilots had actually held the KC-97 within 20 ft. of the predetermined test altitude of 18,000 ft. throughout the lengthy test runs of the 90,000 mi. flight around the world.

Spare parts and maintenance crew for the KC-97 were lost to the project when the C-124 carrying them was grounded by a failure early in the flight. Crew members of the neutron pile carrier kept the study on schedule by working long hours and stepping outside their various specialties to get the work done.

Weight and maintenance problem was caused on the flight by the four big air conditioners needed for the pile, which was designed for ground use. These required a special 60 cycle, 110 watt generator and power circuits. They were needed to cool the pile and hold relative humidity below 78%. Higher humidity would have caused spurious counts.



STRESSES "frozen" in a reactor pressure vessel model (lower right) appear after slices are placed under polarized light (upper left and right). Drawing (center) indicates the orientation of the radial and pie-shaped slices which were cut out of the plastic model head.

Westinghouse Adapts Photoelastic Technique to Visualize Stresses

By Robert Cushman

Pittsburgh—Westinghouse Electric Corp. is using a three-dimensional photoelastic method for obtaining a picture of the stresses in solid parts. Stresses are "frozen" in plastic so that when the part is cut and examined under a polarized light the stress patterns are visible.

This enables a designer to visualize and understand the stresses in a solid part too complex to tackle by purely analytical calculations.

It shows him where the part is likely to fail and should be strengthened and where it is over-strength and can be lightened.

Developed by Milton M. Leven of Westinghouse's Research Laboratories, the method extends conventional two-dimensional photoelastic stress analysis to three-dimensional. It does this by reducing the three-dimensional problem to two-dimensions. Because the stresses in the three-dimensional part are frozen in, the part can be sliced into thin sheets, the two-dimensional patterns of which can easily be analyzed.

In the example pictured, a one-fifth size model of a nuclear reactor pressure vessel was finished-machined from a cast epoxy resin block. It was placed in an oven and the temperature raised to 300F.

The scale 3.25 psi. pressurization loading was applied through a tube leading through the pressure vessel wall. While the internal pressurization was maintained, the oven temperature was slowly reduced until, two days later, the temperature was back to normal room temperature. The pressure was then released but the stresses remained "locked-in."

Sample Slices

The flat samples sliced from the model after it was removed from the oven show (when viewed with polarized light) the stress-optic patterns which were experienced by the sample elements when they shared the imposed stresses with their neighboring elements as part of the original solid. The patterns in the slices are not only straightforward but are susceptible to quantitative analysis.

The method of quantitative photoelastic stress analysis is to work from

known areas to other known areas. For example by counting the interference lines between the neutral point to the known edge stress in a portion which is undergoing beam bending gives the calibration value of each interference line which can then be traced into other more complex areas.

A drawback of this system for the pressure vessel, Leven said, was due to discrepancies in Poisson's ratio in the pressure vessel walls.

The higher Poisson's ratio for the model (.45 as against 0.3 for the prototype) caused higher circumferential bending stress in the walls.

Military Suggests Reliability Remedies

New York—Avionics, despite great strides, has not kept pace with the demands imposed by advances in aerodynamics, propulsion and weapon system complexity, top military and industry leaders warned during a symposium held at the recent American Ordnance Assn. meeting here.

Familiar complaints about avionic equipment unreliability, complexity, size, weight and cost were accompanied by specific suggestions for improvement:

• **Function integration:** Large gains in space and weight can be made by integrating redundant functions found in different equipments, Col. Gordon T. Gould, Jr., told the AOA. Gould is chief, Communications and Electronics Division, Headquarters Air Research and Development Command. Pointing to the rapid growth of avionic equipment aboard aircraft, Gould said that much of it has common components and functions that could be eliminated by more complete systems engineering.

• **Reliability:** USAF has established a program aimed at qualitatively measuring the degree to which its contractors are aware of latest state-of-the-art and are putting it into practice, Gould reported. Proposals for development contracts must now contain an outline of the program the contractor intends to pursue to achieve reliability, with subsequent progress reports on his reliability program. However, Gould said, for maximum effectiveness a quantitative basis for measuring and evaluating reliability is needed. "We also need improved methods of component testing which will insure both initial and long-life quality," Gould said.

• **Cost Reduction:** "Complex new systems are pricing themselves out of the market. Costs must come down," was the warning sounded by Rear Admiral Rawson Bennett, chief of Naval Research. The solution, as Adm. Bennett sees it, is more automation. However, such automation must be designed for flexibility and short run production.

• **Better Management:** Order of magnitude change in the quality of military-industrial management of defense programs is needed, according to Adm. Bennett. "We must do better at deciding when something is good enough for the job," he said. "We cannot go on forever gilding the lily, polishing the chrome, demanding the best, the latest, regardless of cost when somewhat less will do the job adequately."

Speaking as an avionic industry representative, Daniel E. Noble, vice president of Motorola, said that as a result of the tremendous growth in the number of tasks which avionics equipment has been asked to perform and the increased complexity of these tasks, "we have moved too far and too fast to permit the normal orderly processes of refinement and improvement to stabilize designs and mature products to the required level of producibility and reliability in field operation," Noble said.

Progress Challenge

"We can argue with sound reasoning that this approach . . . has been essential . . . to meet any potential frontier challenge which might outclass our ultimate pattern of defense and strategic protection of our country," Noble said. "We can also thank God that we haven't been . . . faced with the necessity for placing thousands of each type of the hundreds of electronic systems in successful operation on a war basis of daily field operation. We would soon be faced with the utter collapse of our broad front of electronic capability . . . brought about by our inability to service and maintain the equipment."

Noble listed the basic elements which he believes are required to solve the reliability-maintainability problem:

• **Use of modular and sub-modular** construction to permit maintenance by substitution of sub-modules.

• **Test procedures,** coordinated with a modular construction plan, which permit speedy identification of faulty sub-modules.

• **Printed circuitry,** automatic assembly and sealed modular construction to improve uniformity and producibility and to protect equipment in the field from overzealous maintenance personnel.

• **Transistorization** wherever possible to eliminate vacuum tubes, making possible wider use of sealed modules.

Agreement on Concept

Gould expressed agreement with the concept of module packaging for speedy fault finding and equipment repair. If module cost can be made low enough, the "throw-away" module becomes feasible, he said. Gould also said that automation manufacturing techniques can improve maintainability and reliability.

"The level of training of our maintenance personnel has not kept pace with the increasing complexity of our electronic equipment and there is little likelihood of closing the gap," Gould said. The USAF has no illusions about the possibility of eliminating complexity, but feels that there is much that can be done to make it easier to live with complexity, he said.

"New testing techniques and good test equipment are part of the answer," Gould said, "but are not entirely satisfactory when the test equipment becomes so complex that it requires special test equipment to test the test equipment."

Price Of Progress

The progress in new components has been so rapid that design engineers cannot keep up with component development, Col. Richard J. Meyer told the AOA. Meyer is chief, Research and Development Division, Office of the Army Chief Signal Officer.

As an example, Meyer cited the prolific transistor industry which comes out with new and improved type transistors before an equipment engineer has completed designing the earlier model into his circuits.

Meyer reported that the Army is transistorizing combat area equipment, including radio gear operating up to 70 mc., wherever possible. The army now has one complete transistorized equipment in production and 12 transistorized equipments in pre-production or service test stages. When the latter go into production, in about two years, 5,000,000 transistors will be used just for initial production, Meyer said.

When another 59 transistorized equipments now in development get into production in perhaps three to five years, they may require a total of 100 million transistors, he estimated. In event of a Korean-type mobilization the Army would need 10 million transistors just for its portable walkie-talkie radio

Army Transistorizes

Following is a list of some of the transistorized equipment which the Army now is developing and the approximate number of transistors used in each:

- **Multiple target coordinate data set: 300**
- **Single target coordinate data set: 235**
- **Teletypewriter set: 345**
- **Frequency meter: 98**
- **Automatic central office switchboard: 4,300**
- **Digital data converter: 110**
- **Teletypewriter switching center: 2,000**

equipment. He also noted that the Army is making "maximum utilization" of transistors in its new missile developments.

Miniaturization Problems

Although panel speakers stressed the need for more miniaturization, several cited problems which can result from too much miniaturization. For example:

• **Transistors,** whose small size normally is considered to be a great boon, are difficult to handle and place automatically in printed circuit boards because of their small size and configuration, Col. Meyer said. He called for more efforts to permit automatic placement of transistors in printed circuit boards.

• **"Perverted miniaturization"** was term applied by Adm. Bennett to some equipments which are so congested and compressed that jeweler's skills and instruments are needed to manufacture and/or repair them. Adm. Bennett admitted that such equipment "may meet written specifications, but it does not display common sense." The impracticability of specifications must be brought to the attention of military/industry top management in sufficient time, he warned.

However, Adm. Bennett pointed out that new techniques may provide major size reduction without the adverse high-density construction or extreme miniaturization. For example, he cited a new integrated airborne digital computer which weighs 39 lb. and occupies only 0.6 cu. ft. It replaces a number of separate analog computers whose total weight is 114 lb. and whose size totals 3.2 cu. ft.

Despite its small size, the device is essentially two computers in parallel which should provide increased reliability, Adm. Bennett said. Although he did not identify the computer, he may have been referring to a new airborne digital computer, called Transac, developed by Philco. The device recently was delivered to the Navy for evaluation.

Datamation Industry Aims for $10 Billion

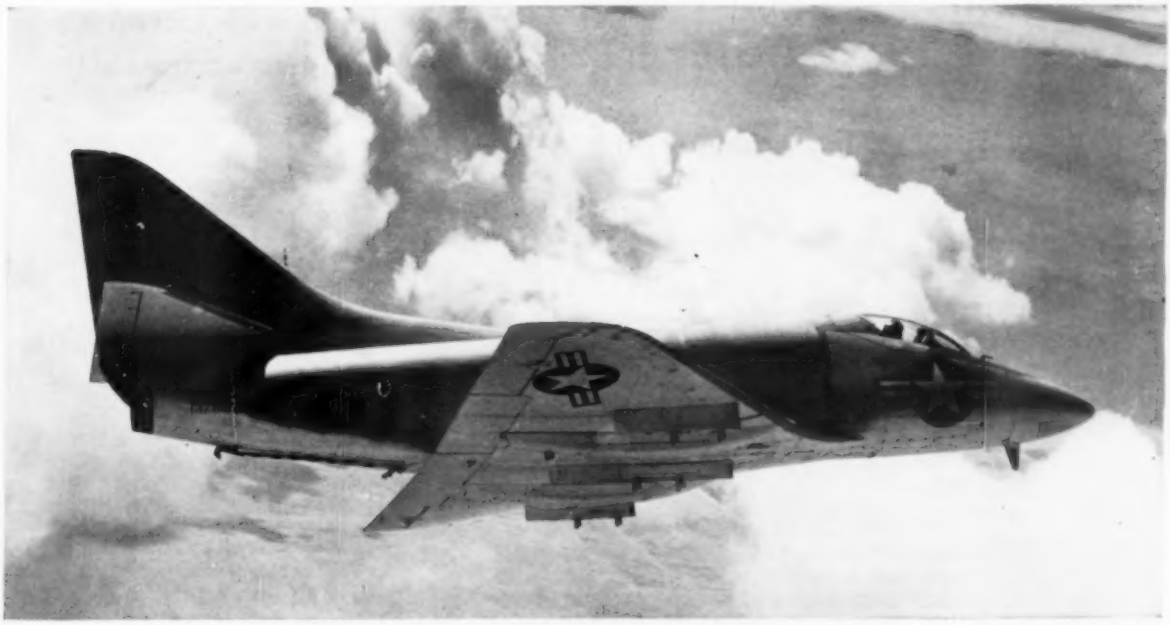
New York—The datamation industry is turning out more than a billion dollars worth of computers and electronic data processing equipment annually and should hit $10 billion before reaching a saturation point. This prediction was voiced by Dr. H. T. Engstrom, keynote speaker at the Eastern Joint Computer Conference. Engstrom is deputy director of research for the National Security Agency.

Another prediction, that solid state devices such as transistors, magnetics, and diodes will replace vacuum tubes in all but extremely high temperature applications, was made by the Conference Chairman James R. Weiner of Remington Rand Univac, Division of Sperry-Rand Corp. This prediction was substantiated by the large number of technical papers given during the conference which described new computer solid state devices and circuits.

The use of solid state devices in place of vacuum tubes should provide a "significant improvement" in computer reliability, according to Robert Campbell of Burroughs. Campbell also predicted that machine costs would come down with the use of automation techniques to manufacture computer sub-assemblies.

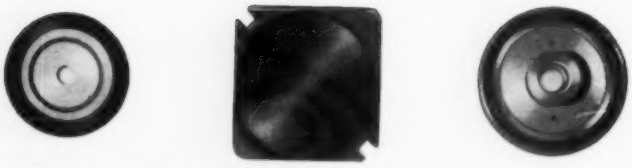
The next five years will see computers whose capabilities exceed those of present designs by the same factor as present computers outperform the old mechanical calculator, according to J. P. Eckert, Remington Rand Univac, Division of Sperry-Rand. Eckert described such a machine, called LARC, now under development for the Atomic Energy Commission and the Navy. First LARC will be delivered in 1958. Eckert also predicted that the use of automatic programming techniques will make it possible to simplify computer design, reduce its cost.

Dr. Engstrom criticized the datamation industry for overly optimistic estimates on delivery and performance of new equipments. "It is better to have equipment on time, even though it may operate at only one-half the speed which may be technically feasible," he



Douglas A4D Stresses Simplicity

Deliveries have begun of Douglas A4D jet bombers to Navy squadrons in the Atlantic and Pacific fleets, following completion of Fleet Introduction Program Trials at the Quonset Point, R. I. Naval Air Station (AW Oct. 8, p. 23). Smallest and lightest of U. S. jet combat planes, A4D was designed with minimum number of parts and good arrangement for ease of maintenance. A4D made good availability record in FIP trials, Douglas reports.



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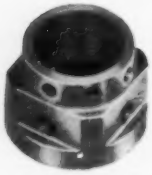

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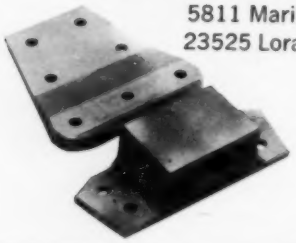

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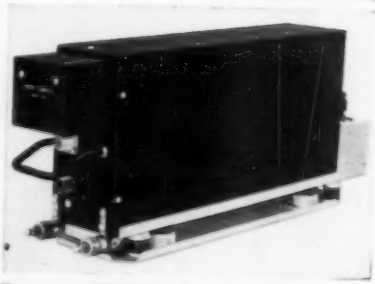
said. Dr. Engstrom also criticized the industry for proselytizing of engineering and scientific personnel, with a resultant spiral in salaries and manpower instability.

However, he concluded that the datamation industry had made tremendous achievements in the past decade and was an important defense element.



Lear Will Introduce Transistorized ADF

Lear has announced a new all-transistor automatic direction finder weighing only 18½ lb., believed to be the first transistorized ADF. It will be available shortly after the first of the year.

The new Model ADF-100 operates directly from 28 volts d.c., consumes only 0.3 amps. Receiver comes in a ½ ATR-size case. The new ADF provides continuous coverage over three bands: 190-405 kc., 400-850 kc., and 800-1,705 kc. The remote control head, with edge lighted panel, provides tuning and volume controls, function selector, CW switch and a two-speed manual loop rotation switch.

The ADF-100 includes a ferro-dynamic loop antenna, hermetically sealed azimuth indicator, available with either fixed or rotating cards. Receiver sensitivity is quoted at 10 microvolts on bands one and two, 20 microvolts on band three, for 50 mw. output at 6 db. signal-to-noise ratio. Average selectivity is quoted as 3 kc. at 6 db. down; 8 kc. at 60 db. down.

Lear says the new ADF has been designed to comply with CAA and Radio Technical Commission for Aeronautics requirements.

Components Industry Could Meet Demands

Washington—High-temperature, high-reliability resistors and capacitors needed for avionic applications might prove a bottleneck in event of all-out mobilization, but otherwise the U. S. components industry is confident it could meet expanded needs.

Resistor, capacitor and relay manufacturers' representatives, meeting with Business and Defense Services Administration (BDSA) officials recently to discuss mobilization requirements, were considerably more optimistic than quartz crystal manufacturers were at an earlier meeting (AW Dec. 3, p. 107).

Highlights of the industry groups' reports are as follows:

• **Resistors:** Growing need for resistors capable of withstanding high temperature, shock, vibration and other rugged environmental conditions "might substantially reduce the industry's ability to produce in the quantities necessary." In some instances, military specifications lag behind present state-of-the-art and as a result, many avionic equipment makers now are issuing their own specifications. The resulting multiplicity of specifications for the same item is becoming a burden on the industry.

To ease this problem, it was recommended that the Armed Services Electro Standards Agency (ASESA) be given the authority and staff to develop military specifications for resistors whose use would be compulsory. Industry spokesmen expressed concern over potential shortages of fine sizes of nickel alloy resistance wire, insulated resistance wire, precious metal contacts, small precision bearings and other materials used in resistors. BDSA promised to investigate the recommendation.

• **Capacitors:** Increasing demand for high-reliability types for avionic applications will reduce substantially the industry's ability to meet mobilization requirements.

Such components require procurement of long lead-time testing equipment and hiring and training of skilled technicians. Both impose heavy loads on resources of small and medium-size companies. Spokesmen expressed concern over possible shortages of tantalum, pressure seals, metal cases, capacitor grade paper and thin aluminum foil, in event of mobilization.

• **Relays:** Deficiency in industry capacity to produce certain types of relays, disclosed by Government survey made in 1955, has been overcome by facilities expansion since the survey was made, according to industry representatives. With additional expansion now under way, industry representatives unanimously voiced confidence that they could meet mobilization needs.

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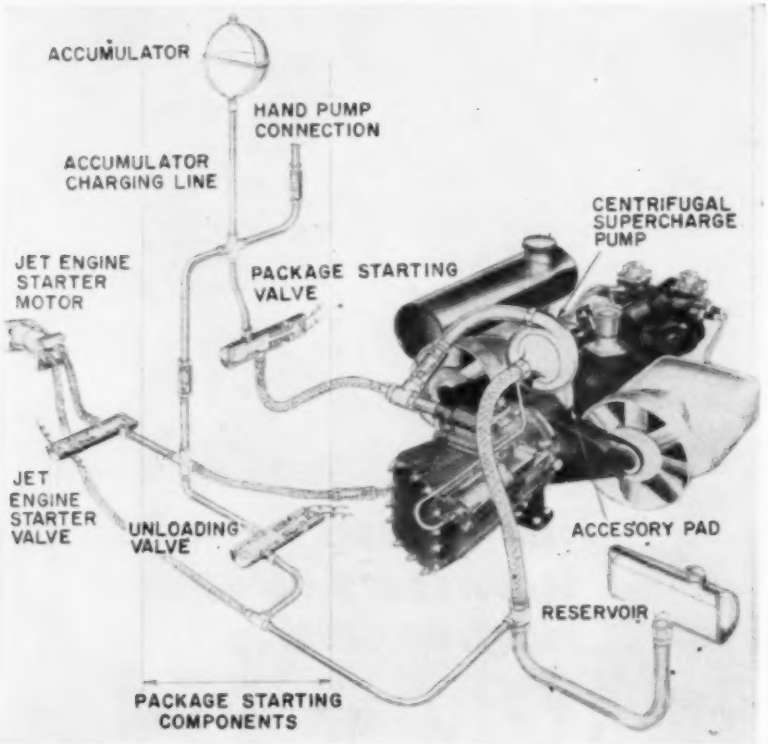
Pack Adds to Helicopter Self-Sufficiency

By George L. Christian

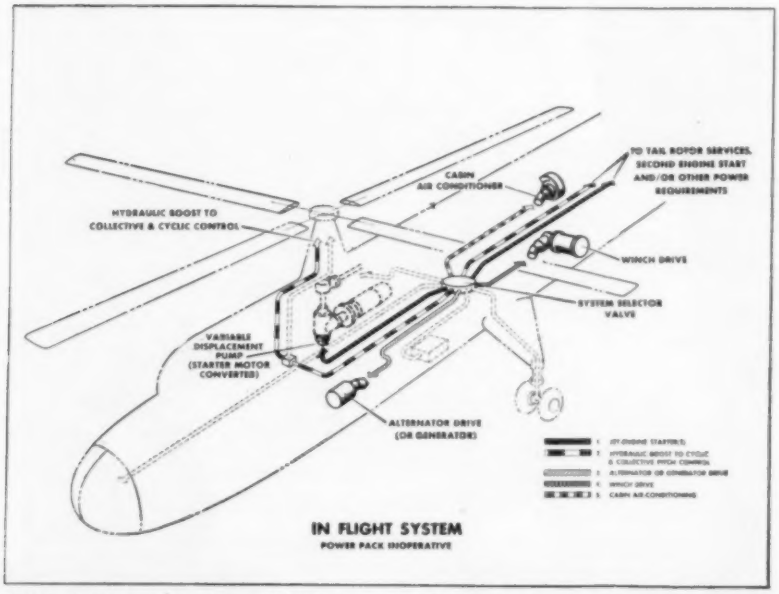
New York—Gasoline engine driven power pack, designed to make helicopters self-sufficient, has been developed by Vickers, Inc. It is small and light enough to install in large helicopters.

The unit can supply power to start engines, taxi the helicopter with rotors folded, drive electrical generating equipment, operate loading ramps. It will allow helicopters to operate from advanced bases and inaccessible locations where ground support equipment is not available.

It will give helicopters the added advantage of not having to idle their engines to supply power for auxiliary services.



SCHEMATIC of the Vickers power pack shows 4-cylinder engine at the back driving front-mounted pump which supplies pressure to jet starter motor.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IN FLIGHT SYSTEM
POWER PACK INOPERATIVE

SOME of the many services which the power pack can operate are shown. Included are: cabin air conditioner (for ambulance helicopter), winch drive, and alternator drive.

Prototype Unit

Breadboard prototype of the unit has been built with power output capable of starting the Allison T56 turbine engine.

(At a recent meeting here of the American Society of Mechanical Engineers, helicopter manufacturers stated that many of their future concepts embody the T56.)

Small helicopter engines can normally be started on the ship's battery without assistance from external power sources. By the time engines get as big as the R2800s used on the Sikorsky S-56, additional power assist sometimes becomes necessary.

When the T56 becomes a helicopter powerplant, an external power source will be essential.

Vickers recently took its power pack to Allison's plant at Indianapolis and used it to start T56 engines, with and without propellers.

(The T56 currently is being used as powerplant for the Lockheed C-130 and later will power the Lockheed Electra.)

T56 Start

The engines were turned over by Vickers hydraulic motors energized by the power pack. Vickers engineers told AVIATION WEEK that the propellerless T56 started in 20-21 sec., the propeller-equipped T56 in 40-41 sec. Allison officials regarded the starts as satisfactory, Vickers said.

There are other important considerations in making a helicopter self-sufficient for combat conditions.

• **Camouflage.** Helicopter with its rotor blades in normal position is very difficult to camouflage because of the dis-

FIRST PICTURES of a hydraulically-powered taxi motor mounted on the main wheels of a Sikorsky HR2S-1 helicopter. Device is used to taxi the machine when its rotor blades are folded. Forward speed and turns are controlled through main engines which drive pumps powering individual motors. Units may be quickly removed from wheels when not needed.

tinctive rotor pattern and because of the large rotor disc area which must be concealed. These considerations, which parallel the necessity of slimming a helicopter's profile as much as possible for shipboard operations and stowage, make folding rotor blades a necessity for large machines. The pack can supply the power necessary for blade folding.

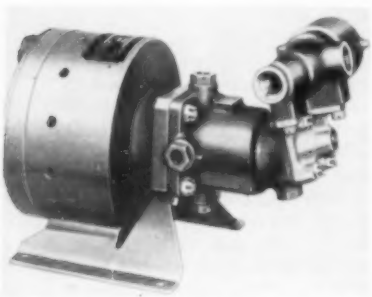
• **Mobility.** When operating in the field, a helicopter must be able to taxi, even with its blades folded. Sikorsky's S-56 twin-engine machine has tested hydraulically-driven power units attached to its main wheels which enable it to taxi independently of the rotors.

• **Weight saving.** Power pack, including plumbing and controls for a twin-engine helicopter, weighs about 184 lb. With wheel drive, the weight goes up to about 224 lb. A typical gas turbine engine on a new large helicopter will burn about 610 lb. of fuel per hour while idling.

Weight Economy

Thus the ability to shut down and re-start engines without the assistance of ground equipment affords fuel and therefore weight economy.

Other services which the pack can power are: lowering and raising loading ramps, driving hoists or winches, powering cabin air conditioners in ambulance helicopters, running electrical generating equipment for communications work and for lighting, and supplying emergency in-flight power should normal power sources fail or become battle-damaged.



HYDRAULICALLY-DRIVEN, 1 kva. alternator developed by Vickers for self-sufficient helicopters.

Standard Equipment

Sikorsky told Aviation Week that taxi motor drives will be standard equipment only on Navy models of the twin-engine helicopter, designated HR2S-1. The drive will normally be a piece of deck equipment stocked by the carrier and used to taxi the machines when their rotor blades are folded.

Vickers officials said their hydraulic power pack is lighter, smaller, and more efficient than other auxiliary power sources of equivalent power output, such as gas turbine types. They cite as additional advantages of the hydraulic power pack: initial procurement costs are lower, it is less susceptible to environmental conditions, more reliable in service, and it is easier and cheaper to maintain because major components are known and understood by most maintenance personnel.

The Vickers hydraulic power pack is driven by a 72 hp. McCulloch four cylinder opposed air cooled engine. (A German Porsche sports car engine was tried, but was too heavy.) Twin belt-driven fans force cooling air over the cylinders. Engine and governor weigh 79 lb.

Engine Drives Pump

The engine drives a Vickers variable displacement pump which supplies hydraulic power to a selector valve (or whatever unit is desired). From the selector valve, hydraulic power may be supplied to any of the services previously listed.

Completing the system are: fuel tank of about 1.5 gal. capacity for the engine; 100 cu. in. capacity hydraulic fluid reservoir; hydraulic motors; accumulator, and necessary valves, plumbing and controls.

Vickers considers it an advantage to be able to motorize the main hydraulic pump to start the gasoline engine by energizing it with power stored in the accumulator.

The accumulator will provide power for an almost indefinite number of starts because, as soon as its stored energy is dissipated, a hand pump can be used to pump it again quickly. This unlimited starting capacity in effect guarantees the helicopter's ability to take off from wherever it lands. Another weight-saving factor is that the

Weight Breakdown

Here is the estimated weight breakdown for Vickers' power-pack for a twin engine helicopter:

	lb.
Engine with Governor	79
Muffler	4
Hydraulic Accumulator	6
Cooling Provisions	5
Fuel Tank	2
Fuel (1.5 gals.) for estimated 25 starts	9
PV-3918 Pump with Power Limiting Compensator	28
Hydraulic Fluid (170 in.)	5
Reservoir (100 cu. in. capacity), filter, relief valve, and flow measuring orifice	5
Solenoid engine selector valve and manifold (two engines)	4
Plumbing	3
Power Pack Total	150
Starter Motor with Overspeed Device	17
Total Starter Weight (two per helicopter)	34
Total Weight for twin-engine helicopter	184

single pump serves as two units—starter and pump.

Vickers said that the power pack was developed with the T56 starting power requirements in mind. Other services provided by the pack would normally require less energy. However, similar self-contained packs of considerably different power outputs could be made available without difficulty.

Vickers has hopes that at least two types of helicopters will use its present power pack.

Currently Vickers has only the single, breadboard model available. The unit was developed entirely at company expense.

OFF THE LINE

Flexonics Corp., developer and manufacturer of flexible metal hose and associated products, has acquired Flex-O-Tube Division of Meridan Corp. Flex-O-Tube makes couplings and hose assemblies in rubber and plastic. Flexonics' home office is in Maywood, Ill., Flex-O-Tube in Inkster, Mich.

Four men in the center, wearing aluminized asbestos suits, have just rescued a man-sized dummy from a mock airplane fire at Chicago's Midway

Airport. The men are wearing air type respirators under the suits. Suit respirator, named Fire King, is manufactured by Wheeler Protective Apparel, Inc., Chicago, Ill.

New 2,000 lb. capacity lift truck features greater power and fast, easy operation. It is powered by a 4-cyl. air-cooled engine which may be operated from conventional or LP-gas. A constant-mesh transmission assures long

life and smooth shifting. The truck may be equipped with new, optional attachments to increase its versatility. Labeled Model QC, the vehicle is manufactured by Hyster Co., 2902 N.E. Clackamas St., Portland 8, Ore.

More than seven miles of underground pipe comprising the hot water heating system currently being installed at New York International Airport is being protected with Gilsulate insulation. The granular material is poured around the pipes and fuses to them when they become hot. It acts as both a protective coating against underground corrosion and also as an insulating medium.

Switch from Vickers to New York Air Brake hydraulic pumps was made by Lockheed Aircraft Corp. on its new 1649 Super Star Constellations. All previous Constellation models, from the original 049 to the current 1049, used four Vickers pumps as the main source of hydraulic power on the airplane, one pump being in mounted on each engine. The new installation will also include four pumps called Stratopower 65WC series. Lockheed increased the hydraulic system's operating pressure from 1,700 psi. to 3,000 psi. on the Model 1649.

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Air Force will receive more than 1,000 portable Sperry electronic engine analyzers under a recent $1,294,000 contract. Use of printed circuits and other manufacturing improvements have kept the weight of these advanced models to the same 35 lb. the older

units weighed. Instruments, which include 5-in. oscilloscopes, will be used at all USAF air bases which have piston-engine aircraft. Air Force's piston engine planes fly about 6 million hours yearly, almost twice that of jets, according to Sperry.

B-58 Uses Bonding in Primary Structure

Portions of the Convair B-58 Hustler supersonic bomber's primary structure in fuselage, wings, and tail assembly are cemented together with a strong structural bonding adhesive.

Use of the bonding film in place of rivets results in greater strength for the primary structures on which it is

used, according to Convair. The company says that use of the cement also makes possible substantial weight savings and more efficient manufacturing procedures.

The aluminum-to-aluminum bond produced by the adhesive is sufficiently vibration and heat resistant to make its use on the B-58 feasible.

The bonding film was developed by Convair and the B. F. Goodrich Industrial Products Co.

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NEW BENDIX TRUE MASS FUEL FLOW SYSTEM APPLIES ANGULAR MOMENTUM PRINCIPLE WITH SINGLE TURBINE

Increased accuracy and greater reliability are the two big advantages of the new Bendix *Single-Turbine* Mass Fuel Flow Transmitter designed for systems application in both single- and multiple-engine jet aircraft. (Type 9151 Transmitter is shown above).

The accuracy of the Single-Turbine Type Mass Fuel Flow Transmitter is *within 1% of actual flow*, regardless of flow rate, type of fuel, or environmental conditions. The new, single turbine is responsible for this greater accuracy because of its reduced friction, reduced fluid coupling, and insensitivity to aircraft accelerations.

The simplified design and fewer parts of this Bendix angular momentum transmitter also make possible longer, more trouble-free service life, and *its use to measure flow in either direction.*

Other advantages: low pressure drop, light weight, available in a variety of flow ranges to fit the application.

While this transmitter is new, it fits into a variety of systems—both new and old. Ask us for publication No. 56-217. PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAVENPORT, IOWA.

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SUPERCHARGED E50 Twin-Bonanza with top speed of 240 mph. will be one of Beechcraft's ace cards in 1956 sales campaign.

BONANZA H35 has more powerful engine delivering 240 hp.; eight-place E18S (below) has range increased to 1,626 mi. with reserve.

Beech Aims for Sales of $46 Million

By Erwin J. Bulban

New York—Business aircraft sales of approximately $46 million will be aimed at by Beech Aircraft Corp.'s distributor-dealer network in 1957, a goal topping the $40 million in domestic and export business handled in the sales year recently concluded (AW Dec. 17, p. 34).

As a measure of the fast-growing rise of the business aircraft market, Beech spokesmen note that the 1956 sales record is 437% increase over the company's 1950 mark. U. S. commercial sales, which reached $34 million last year, have more than doubled in the last two years, compared with $16 million achieved in 1954.

Shown to approximately 300 Beech distributors, dealers and sales representatives from the U.S. and 10 foreign countries at its annual sales meeting in Wichita, Kans. earlier this month, was the 1957 25th Anniversary line including the new supercharged version of the Twin-Bonanza, a high-powered Bonanza and an improved Super 18.

French Jet

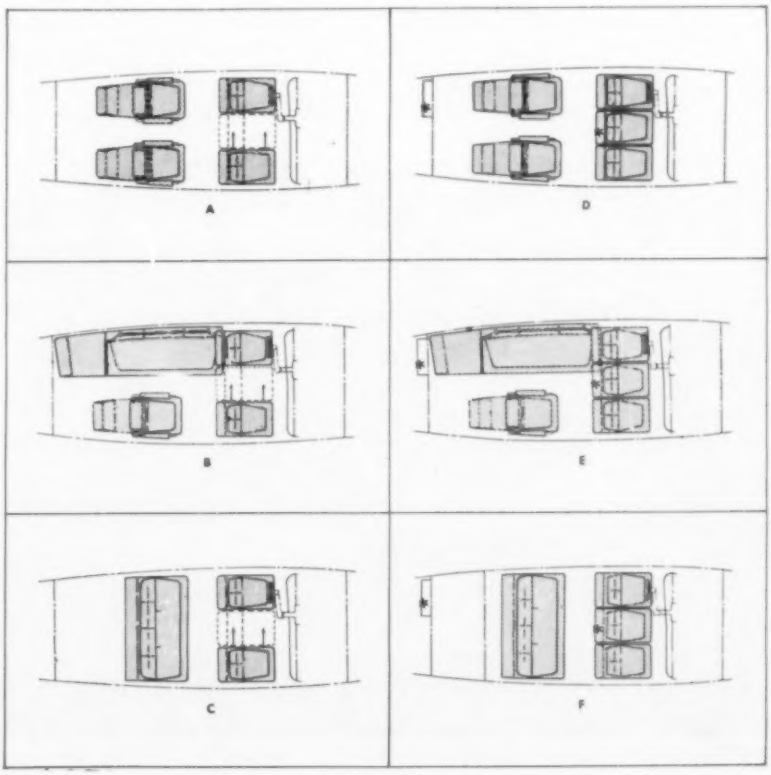
Formal announcement of the new Model 95 Travel Air light twin is expected to be made in March. Present plans include a nationwide tour. Still active in the company's future planning is the twin-jet Morane-Saulnier MS-760 Paris.

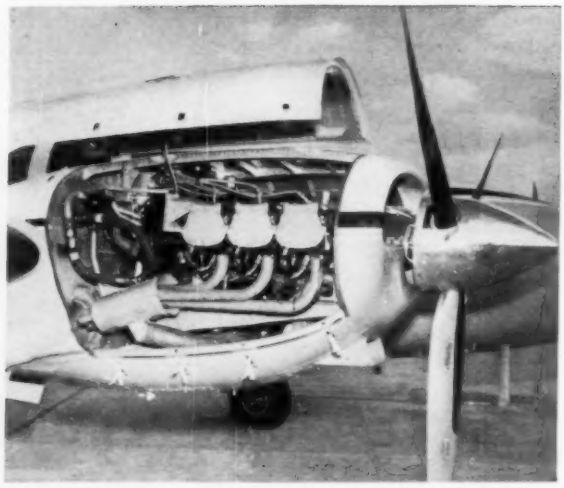
This airplane was returned to the U.S. by Beech and demonstrated last month to the military in Washington and Norfolk, Va. The company is primarily interested in selling the Navy the MS-760 as a very-important-person transport and as an economical vehicle for jet qualification. Should a military production contract for the airplane be forthcoming, chances are good that Beech would also offer it as a highspeed business plane.

Beechcraft's first production plane powered with supercharged engines, the new E50, has a top speed of 240 mph. and cruises at 228 mph. at 70% power of its two six-cylinder 340-hp. Lycoming GSO480-A1A6 engine. It has a service ceiling of 24,800 ft.

The company is also offering the D50 model of the Twin-Bonanza having high-compression Lycoming GO-480-C2D6 engines rated at 295 hp. on takeoff. Top speed of the D50 is 203 mph. at 70% power; cruise speed is 201 at 65% power. The company reports direct operating costs, fuel and oil, of $13.98/hr. for the

VARIETY OF SEATING is possible in 1956 Twin-Bonanzas utilizing a couch and E18S-type chairs. Diagram below shows six layouts possible; asterisks indicate stowage of removable center seat back. Copilot's seat slides to left in arrangements A, B and C.





SUPERCHARGED 340-hp. Lycoming on E50 is exposed by lifting quick-opening cowl. Retractable step (right) replaces former small unit.

E50 and $11.44/hr. for the D50.

The E50, at maximum gross weight of 7,000 lb., climbs at 1,620 fpm. at sea level compared to the D50, which at 6,300 lb. gross, climbs at 1,450 fpm. The E50 uses 940 ft. of ground roll for take off with 20 deg. flaps, lands in 1,250 ft. over a 50-ft. obstacle. The D50 gets off in 905 ft., with the same amount of flap lands in 1,260 ft.

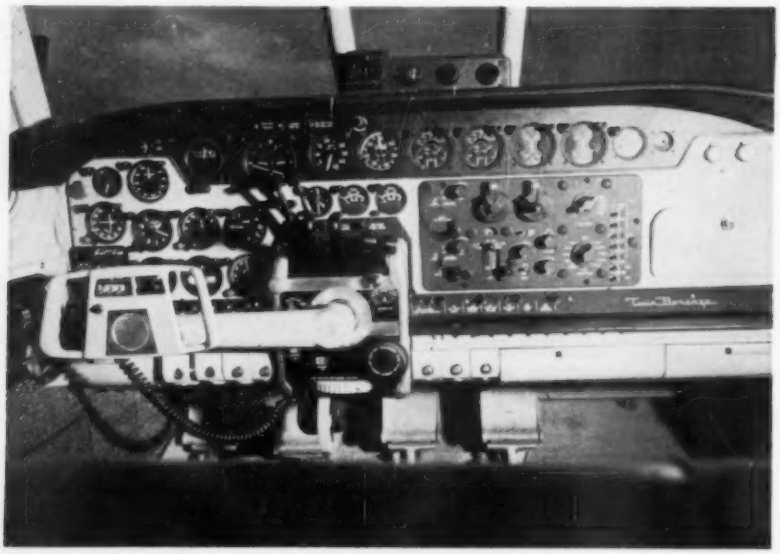
Seating Arrangements

In addition to the new engines made available on the 1957 Twin-Bonanzas, customers now have a choice of any of six seating arrangements utilizing a couch and Super 18 reclining chairs. Another major improvement is a new instrument panel arrangement. Previous Twin-Bonanzas had a "false" panel in which the instruments were submerged; the new version has flush-mounted dials, permitting more utilitarian grouping and installation of a greater variety of equipment.

Because of increasing installations of radio and navigation equipment in business aircraft, Beech in 1957 is providing three optional radio packages for Twin Bonanza installation:

- **Package A,** at $4,575 and weighing 57.7 lb.: Aircraft Radio Corp. T-20 20-channel VHF transmitter, ARC 15D omni, Flite-Tronics CA-1A audio amplifier, Lear 2217A VHF antenna and microphone and headset.
- **Package B, priced** at $7,725 and weighing 94.5 lb. installed: Narco Sapphire 1016 90-channel VHF transceiver, ARC 15D omni, ARC T20 20-channel transmitter, Flite-Tronics CA-1A audio amplifier, Narco Sapphire 1016 antenna and microphone and headset.
- **Package C** costing $8,275 and weighing 90.9 lb. installed: Lear LTR-800 transceiver, ARC 15D omni, ARC T20 20-channel transmitter, Flite-Tronics CA-1A audio amplifier, Lear 2217A antenna and microphone and headset.

Also available, factory installed, are the ARC Type 21 ADF ($3,075); Lear ADF-R14 ($2,425); Flite-Tronics MB-3 marker beacon receiver ($875); Lear 2200B market beacon receiver ($750); ARC type R11A low-frequency range receiver ($925); ARC 15D omni for dual installation ($2,525); Wilcox 700 B10-channel glideslope receiver $1,515), and ARC CD-1 course director with stabilized compass system ($2,525).



NEW FLUSH PANEL on Twin-Bonanzas allows more freedom in mounting equipment.

Flyaway Price

Factory flyaway price for the E50 without radio is $88,000; the 1957 D50 is $77,000. Auxiliary 50 gal. wing tankage for the E50 costs $2,815 extra; auxiliary 46-gal. tankage on the D50 costs $735. Both models include in their standard equipment the retractable airstep which folds under the fuselage. This step retracts when the fuel pressure on the right engine reaches a predetermined value, opens automatically when the fuel pressure goes off. To prevent inadvertent opening in flight should the right engine fail, the step cannot extend unless the landing gear legs are compressed, as when the airplane is on the ground.

In line with the high-altitude operation possible with the E50, equipment includes Zep high-pressure six-outlet constant-flow oxygen system. This is standard on the E50, optional on the D50.

A more powerful engine, the wet-sump Continental O470-G rated at 240 hp. at 2,600 rpm. for all operations, leads improvements in the 1957 Bonanza Model H35.

The new engine gives the H35 a top

GEISSE CROSSWIND landing gear is being installed on majority of new E18S transports.

speed of 206 mph. and a cruise speed of 196 mph., the latter 6 mph. faster than the previous model. Service ceiling has been raised to 19,800 ft.

In combination with the more powerful engine, the H35 also has as standard equipment a Woodard hydraulic propeller governor to maintain constant propeller speeds. This equipment replaces the previous electric governor, formerly offered as optional equipment, and is a more efficient mechanism, a Beech distributor told AVIATION WEEK. Another powerplant feature is a new carburetor that automatically compensates for changes in altitude, providing improved fuel consumption and preventing improper leaning.

Beech has gone to the package concept for the radio installations on the Bonanza. Minus factory-installed radio, the standard H35 sells for $22,650. The three packages available for Bonanza installation include:

- **Package A**, weighing 27 lb. and costing $1,300, comprises the new Narco VTR-2 Omnigator VHF communication and navigation set supplied with 24 crystals covering a range of 118.1 mc. to 122.8 mc., with microphone and headset.
- **Package B** costs $5,000 installed and weighs 53 lb. It comprises the ARC T20 20-channel VHF transmitter, ARC 15D omni, ARC R20 marker beacon receiver, microphone and headset and ARC F-13 cabin speaker amplifier.
- **Package C** is priced at $825 and weighs 25 lb. installed. It consists of the Lear LTRA-6 VHF communications set with marker beacon receiver, low-frequency receiver microphone and headset. This installation was standard equipment on previous Bonanzas and could be exchanged for a Narco VTR-1, if desired.

Optional radio gear offered for factory installation in conjunction with Packages A, B or C includes: Lear ADF-12E ($1,075) available with A or C, or ARC type 21 ADF ($2,775) available with A or B; Narco VC-27 Simplexer unit available with A, and the Lear Omnimeter ($550), available with Package C.

A major interior change on the H35 is individually adjustable front seats. Previous models had a single seat across the front, which was difficult to adjust in flight.

The 1957 E18S, which sells for $106,975 minus radio, features a range increase of 12% over earlier Super 18s. This is achieved by installation of 125 gal. of auxiliary fuel in two wing tanks, 45 more than the previous tank in the nose. Total fuel capacity is now 318 gal. The increased tankage gives the 1957 Twin-Beech a maximum range of 1,626 mi. with 45-min. reserve, no wind, pulling 200 hp. from each engine at 10,000 ft.

Important new feature is inclusion of Geisse crosswind landing gear as optional equipment—$1,500 extra. Beech initially announced the installation last summer (AW June 11, p. 111). Response to this installation is "overwhelming," the company says, and it has been installed on 33 airplanes out of 88 deliveries through Dec. 17. The sales department feels that the large majority of new E18S business transports will be fitted with the Geisse landing gear.

Dealer Benefits

Continuous development of merchandising tools by Beechcraft's sales department is evident in its growing family of financing plans to aid in moving airplanes. Evidence of their importance was the formation of the Beech Acceptance Corp.; in the period April through October, BAC assisted in moving $1,238,000 worth of business aircraft.

Currently available through the company are financing plans permitting buyers to put one-third down, pay the balance in 36 months at 5½% discount rate; 20% down payment, pay in 36 months at a 5½% discount rate; 20% down payment, pay in 26 months at a 4½% discount rate; 20% down payment, pay in 26 months at a 4½% discount rate, or purchase-lease agreement over a four-year period through American Leasing Corp. In addition, some Beech outlets have their own financing plans. Beech notes that its plans are intended as adjuncts to dealer's operations and are not intended to replace their relations with local banks.

The company floor planning arrange-

Auster Produces New Utility Plane

Latest Auster utility plane is the two or three place Alpine featuring new aerodynamically balanced ailerons to improve handling qualities. Two versions of the Alpine are available, one with a 145-hp. DH Gipsy Major 10, the other a 130-hp. DH Gipsy Major 1. Takeoff run at 1,827 lb. gross weight at sea level is 270 ft. with five-mile-per-hour wind, and rate of climb is 1,025 fpm. Maximum indicated airspeed is 128 mph. Still air range at 100 mph. with 32 gal. of fuel is 460 mi. Data applies to the 145-hp. model.

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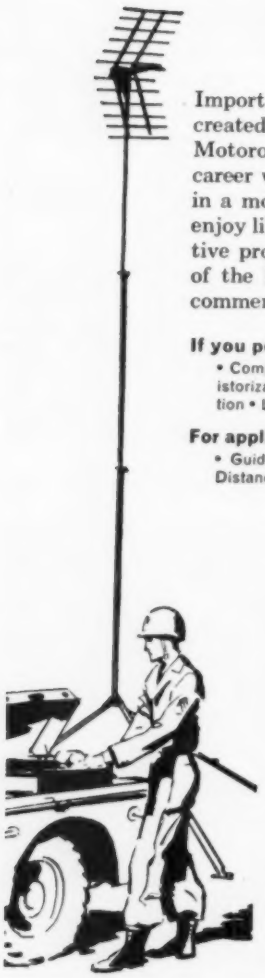

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MOTOROLA

Civil-Military Sales Exceed $74.5 Million

Beech Aircraft Corp.'s total sales for Fiscal 1956 were $74,538,948, with military aircraft, components and support items accounting for $42,447,187.

Backlog as of Dec. 1, amounted to approximately $108 million, compared with $71 million at the same time last year.

Net income after taxes for the fiscal year ending Sept. 1, 1956 amounted to $3,331,327 compared with $3,586,510 in the previous year.

At year-end 1956, Beech employed about 7,000 in five major production facilities covering more than 1.75 million sq. ft. of plant area.

ment, to assist distributors and dealers in financing demonstrator stocks, also is making important headway. Introduced in January 1955, the Beech floor plan has moved $7.8 million, wholesale, of business planes off the production line through last October.

At Beechcraft's annual sales awards banquet, more than 60 individual presentations were made. Highest award—a 1957 Lincoln convertible—went to Dan L. Meisinger, owner of Topeka (Kan.) Aircraft Sales & Service for the greatest percentage of sales increase of the company's three models. Meisinger's firm showed an 86% gain over 1955 sales and totaled $1,343,653.

Second prize in this category—a 1957 Pontiac station wagon—went to Herbert R. Elliott, Elliott Flying Service, Davenport, Ia., whose company showed the largest percentage increase based on a three-year average.

Prizewinners for the best percentage increase in specific categories were:

Thad Robbins, Aircraftco Inc., Wichita, Kan., $1,250 for Bonanza and Twin-Bonanza sales; Harry B. Combs, Combs Aircraft, Inc., Denver, Colo., $1,000, Twin-Bonanza sales; Forest Beckett, Youngstown Airways, Inc., Ohio, $1,000 for Super 18 sales.

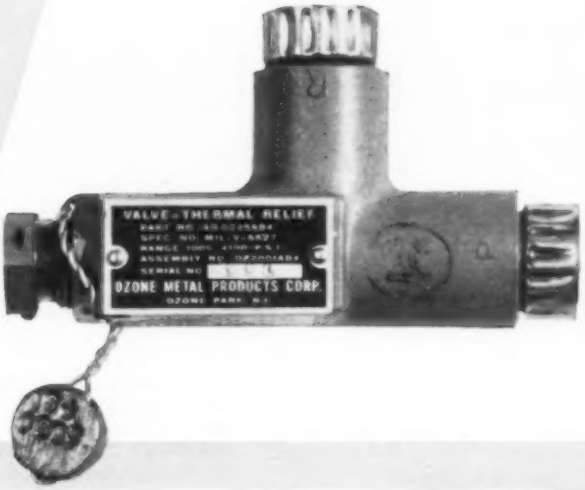
Roscoe Turner Aeronautical Corp., Indianapolis, Ind., received a $500 cash award for winning the company's second annual spare parts competition.

Honored for exceeding $1 million in aircraft and parts sales were 18 domestic and one export distributor:

Atlantic Aviation Corp., Teterboro, N. J. and Boston, Mass.; Norman Larson Co., Van Nuys, Calif.; Atlantic Aviation Service, Inc., Wilmington, Del.; Cutter-Carr Flying Service, Inc., Albuquerque, N. M.; Southern Airway, Co., Atlanta, Ga.; Francis Aviation, Lansing, Mich.; Alamo Aviation, Inc., San Antonio, Tex.

Also: Ohio Aviation Co., Vandalia, Ohio; Topeka Sales & Service; Combs Aircraft, Inc.; Youngstown Airways, Inc.; J. D. Reed Co., Inc., Houston, Tex.; J. R. Gray Co., Inc., Dallas, Tex.; Tulsair Distributors, Inc.; Tulsa, Okla.; Butler Airplane Sales, Chicago, Ill.; Elliott Flying Service, Inc.; Aircraftco Inc.; Aircraftsmen, Inc., Oklahoma City, Okla., and Soc. General de Comercio S. A., Santiago, Chile.

ANNOUNCING Ozone's NEW Thermal Relief Valve



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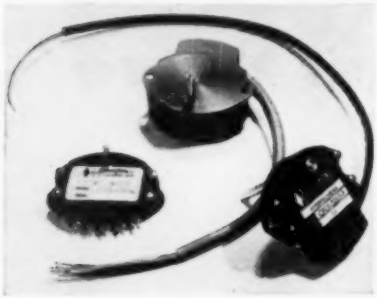
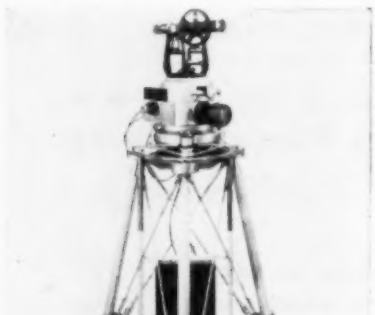


Sector Pots

Precision potentiometers measuring angles of shaft rotation from zero to 90 deg. are designed especially for missile and aircraft control and instrumentation systems. Accuracy is 0.5% and resolution is 0.10 deg. All-metal instruments have temperature insulation, withstand up to 300F. They resist severe environment, vibration, and shock and meet explosion-proof requirements. Three models available all may be had with shaft extension from either or both sides, connecting terminals or integral cables, single or dual units.

Humphrey Inc., 2805 Canon St., San Diego 6, Calif.



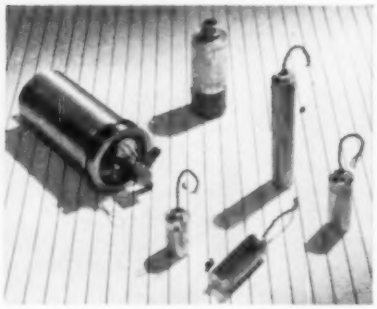
Gyro Aligning Theodolite

Azimuth alignment theodolite permits aligning of precision gyroscopes within 2 sec. of arc. It automatically detects discrepancies in alignment by continuous observation of reflection from mirror mounted on monitored unit. Error signals in the theodolite are used automatically or manually as basis for correction to drive elements of the unit. Theodolite has three major components; optical unit, mount and electronic unit.

Perkin-Elmer Corp., Norwalk, Conn.

Gas Generator Cartridges

Pre-packaged explosive cartridge gas generators can operate turbines, pressurize fluids, actuate pistons and expandable rings and ignite liquid propellants. They combine high energy/storage ratio with reliability factor approaching 100%. The generators create a known amount of gas at predictable pressures

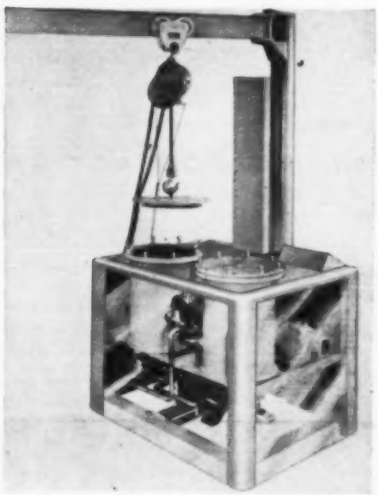


and temperatures for a given time. A wide range of pressure/time characteristics can be engineered to meet specific applications. Outputs vary from 0.01-150 hp. and from 15-25,000 psi. Having no moving parts they are insensitive to acceleration, vibration, etc. Electrical squibs are integral or threaded-in subassemblies. Wiring connections can be made by integral leads or by quick disconnect plugs.

McCormick-Selph Associates, 25 Hollister Airport, Hollister, Calif.

Radiation Shows Leaks

Sensitve, non-destructive leak detection system uses inert, non-toxic gas bearing radioactive tracers. It is well adapted to mass production techniques as sealed units in large quantities can be checked with very low labor costs. No

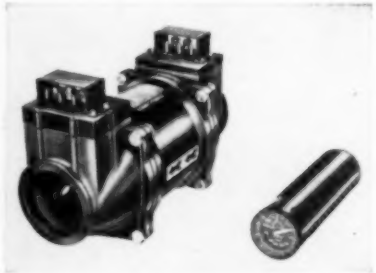


pinch-off tubes are needed. System, called Radiflo is being used in quality control of hermetically controlled containers such as relays, aneroid chambers, special vacuum tubes, pressure and temperature controls, Bourdon tubes and sealed switches.

American Electronics, Inc., Marketing Division, 655 W. Washington Blvd., Los Angeles 15, Calif.

Mass Fuel Flowmeter

Accuracy of gravimetric fuel flowmeter is not affected by variations in density, temperature, viscosity or chemical compositon of the fuel. True mass flow is indicated without auxiliary density correction. System has two units; transmitter located in fuel line and

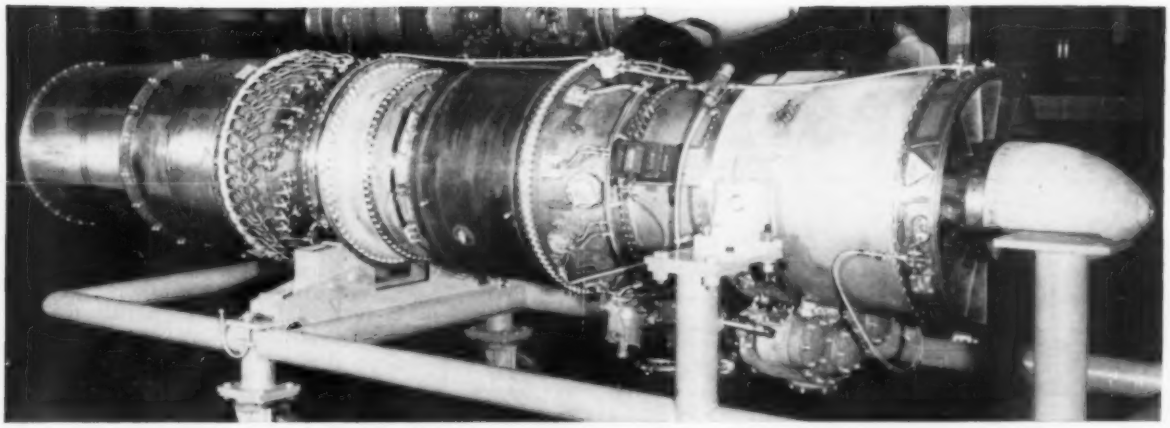


indicator housing electronic circuitry. It operates on torque principal. A constant speed impeller gives uniform velocity to passing fuel. Momentum proportional to mass flow is picked up by spring restrained sensing wheel, deflection of which moves a potentiometer to vary a DC output to the indicator.

Avien, Inc., 58-15 Northern Blvd., Woodside 77, N. Y.

Pocket Computer

Shirt pocket calculator has special scales for solving problems in multiplication, division, exchange rates, currency calculations, cost of merchandise, fuel consumption, speeds, percentages, interest and compound interest, mar-



Tooling Planned for J52

Pratt & Whitney Aircraft is planning tooling for production of its medium size J52 turbojet. First installation is scheduled for Douglas A4D Skyhawk. Design has benefited from experience with J57 and J75 twin-spool engines. Designed for Navy use (including a supersonic trainer), engine has proved attractive for medium range jet transports, Pratt & Whitney said.

gins, counter-offers, circle calculations, areas, volumes, squares, cubes, medial section, fraction-decimal conversion and inch-centimeter conversion. It consists of two aluminum discs and a transparent plastic index.

Silver Bells Ltd., 600 16th St., Oakland, Calif.

WHAT'S NEW

Publications Received:

• **Operations Research, Armament, Launching**—by Grayson Merrill, Harold Goldberg, Robert H. Helmholz—Edited by Grayson Merrill, Captain, USN—Pub. by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, New Jersey. $10.00; 508 pp.

Third volume in the series "Principles of Guided Missile Design," covers the principles of operations research as a basis for guided missile decision-making, armament, and launching systems.

• **Scientific Inventory Control**—by W. Evert Welch, Director of Procurement, Aeronautical Div., Minneapolis-Honeywell Regulator Co.—Pub. by Management Publishing Corp., 22 West Putman Ave., Greenwich, Conn. $12.50; 168 pp.

Book on mathematical inventory control written for the man who must do the job himself.

• **Pilots' Weather Handbook**—available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $1.50.

An illustrated volume which provides information on basic concepts of weather, temperature, pressure, moisture, stability of the air, clouds, general circulation—winds, air masses, frontal weather, thunderstorms, fog and stratus clouds, and weather observations and instruments. Primarily prepared for use by pilots, this handbook would be of value to anyone interested in acquiring a greater practical knowledge of weather.

• **New Horizons, U. S. A.**—compiled by Pan American World Airways with the assistance of American Airlines and tourist information organizations throughout the U. S.—Pub. by Simon and Schuster, Inc., 630 Fifth Ave., New York 20, N. Y. $1.95; 510 pp.

Guide to travel in the United States, primarily designed for overseas consumption, but equally useful for domestic travelers.

• **Wing Theory**—by A. Robinson and J. A. Laurmann—Pub. by New York-Cambridge University Press, 32 East 57th St., New York 22, N. Y. $13.50; 569 pp.

Book includes the "classical" theory of airfoils at low speeds in two and three dimensions as well as some of the latest developments in supersonic flow, a separate chapter deals with unsteady airfoil theory and the hydrodynamic foundations of the subject are developed from first principles.

Reports Available

Following is a list of reports with their order numbers available from OTS, U. S. Department of Commerce, Washington 25, D. C.

• **The Preparation of Single Crystals** of the Oxides of the Transition Elements (PB 121176)—by E. J. Scott, Naval Ordnance Laboratory, 75 cents, 25 pp.

• **Elastomeric Polyphosphates,** Part 2 (PB 121391)—by R. A. Hubbard II and U. P. Strauss, Rutgers University for Wright Air Development Center, $1.00; 37pp.

• **Research and Development** Work on Semiconducting Materials of Unusually High Electron Mobility (PB 121288)—by A. C. Beer and others, Battelle Memorial Institute for Wright Air Development Center, $1.50; 54pp.

• **Measurements and Evaluation** of Electrical Potentials Between Oxide Systems (PB 111795)—by Pennsylvania State University for Office of Naval Research, $1.75; 65pp.

• **The Hall Effect in the Silver-Palladium Alloy System** (PB 121311)—by A. I. Schindler, Naval Research Laboratory, 50 cents; 7pp.

• **A Review of Literature Pertinent to the Design and Use of Effective Graphic Training Aids** (PB 121399)—by E. V. Saul and others, Office of Naval Research, $5.00; 219pp.

A new free price list of Atomic Energy Commission unclassified research reports for sale by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., is now available from OTS on request. To obtain it, request **AEC Research Reports Price List No. 26.** Price lists are issued semi-annually, and the next list will be available in February 1957.

• OTS also publishes **U. S. Government Research Reports,** a monthly publication which lists new research reports as soon as they are released by the AEC. This publication may be obtained on a subscription basis from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. at $6.00 a year ($3.00 additional charge is made for foreign mailing).

engineers:

Cessna's "NEW LOOK" provides greater opportunities than ever!

Our plan for continuous, controlled expansion—based on a healthy balance between military and commercial aircraft projects—pays off for you! Creative freedom and an unhampered pursuit of challenges are part of your "heritage" at Cessna—and, the new, two-story, 44,000 square foot building illustrated below—designed exclusively and specifically for our engineers—can be your new home at Cessna.

You and your family will enjoy making Wichita your home, too! It was not without much forethought that the founders of Cessna located here. Third fastest-growing city in the United States, Wichita is a friendly city . . . a busy city . . . ideal for family life and recreation. The school system is excellent . . . with above-average facilities . . . easily accessible in all residential districts. Why not join Cessna—and GROW with Cessna? Your future is our future!

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- Airframe Stress Analysts
- Flight Test Engineers
- Equipment Installation Engineers
- Design Draftsmen
- Technical Illustrators
- Catalog and Maintenance Writers
- Aerodynamicists

(Competitive salaries to qualified applicants)
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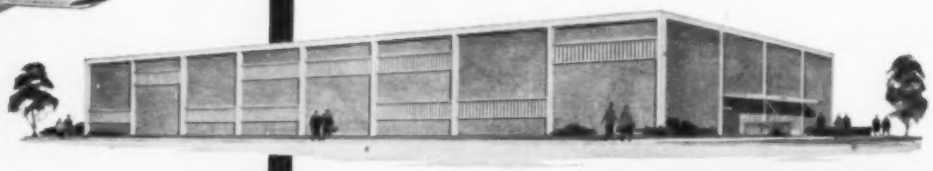

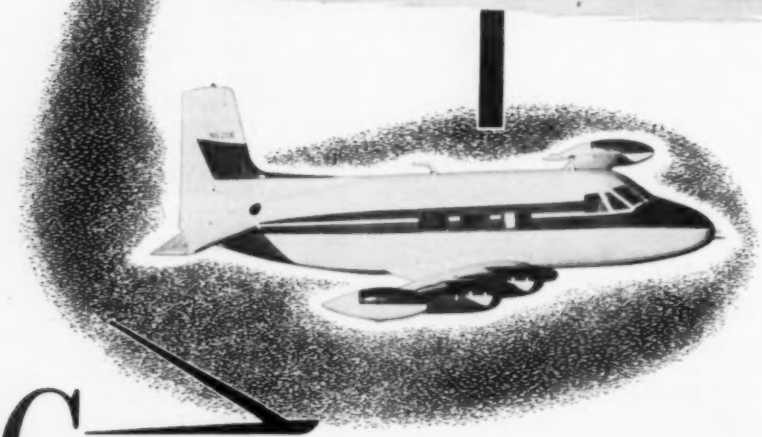

write, wire or call

Professional Placement Supervisor

Cessna Aircraft Company
Dept. AW
5800 East Pawnee Road
Wichita, Kansas

Cessna AIRCRAFT COMPANY

Flight Loads Engineers

for Republic Aviation
Long Island, N. Y.

A large increase in the number of models reaching the flight test phase of development and an increased emphasis on the measurement of flight loads has created some unusual ground floor opportunities in this field.

(1) Flight load engineers at Republic are given a wide scope of action. You will not find the over-specialized restrictive organization so prevalent at the other companies.

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(3) No other field will give you a more diversified experience. You will deal with aerodynamics, structures, systems and instrumentation.

(4) The planned continuing expansion of the department affords excellent means for advancement.

If you have experience in any or all of the following fields, Republic can offer you wonderful opportunities plus happy living on Long Island.

Instrumentation Design for Flight Loads Programs

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Employment advantages at Republic Aviation include company-paid hospitalization insurance, surgical insurance, accident and life insurance, tuition (3½), 2-fold pension plan, individual merit rated increases and many other benefits.

Please send your resume including details of technical background to:

Mr. David G. Reid
Engineering Personnel Manager

REPUBLIC AVIATION
Farmingdale, L. I., N. Y.

EMPLOYMENT OPPORTUNITIES

NATIONAL COVERAGE

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant	Civil Service Opportunities	Employment Agencies
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The advertising rate is $31.60 (effective Jan. 1957) per inch for all advertising appearing on other than a contract basis. Frequency rates quoted on request.

An Advertising inch is measured ⅞" vertically on a column—3 columns—30 inches to a page.

Subject to Agency Commission.

$2.10 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Position Wanted Ads are ½ of above rate.
Box Numbers—counts as 1 line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
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Send NEW ADS to Classified Advertising Div. of AVIATION WEEK, P. O. Box 12, N. Y. 36, N. Y., for Jan. 7 issue closing Dec. 27

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REGIONAL SALES MANAGERS

- Executive management experience necessary in initiating and administering sales programs.
- Experience in supervising and directing a sales organization.
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REGIONAL SERVICE MANAGERS

- Travel out of and headquarter in Wichita.
- Aircraft maintenance background desirable.
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PARTS MERCHANDISING MANAGER

- Must develop and administer a spare parts merchandising program.
- Must aid dealers in setting up and operating parts departments.
- Must have automotive parts experience on zone manager level.

CESSNA

If you meet these requirements and are interested in an unlimited opportunity with the World's Leading Producer of Executive Aircraft, send your resume and recent photograph to the Professional Placement Supervisor, Dept. AW, Cessna Aircraft Company, 5800 East Pawnee Road, Wichita, Kansas. (No phone calls, please.)

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Helicopter maintenance experience preferred but not necessary

If you desire the benefits of a permanent position in a scheduled airline

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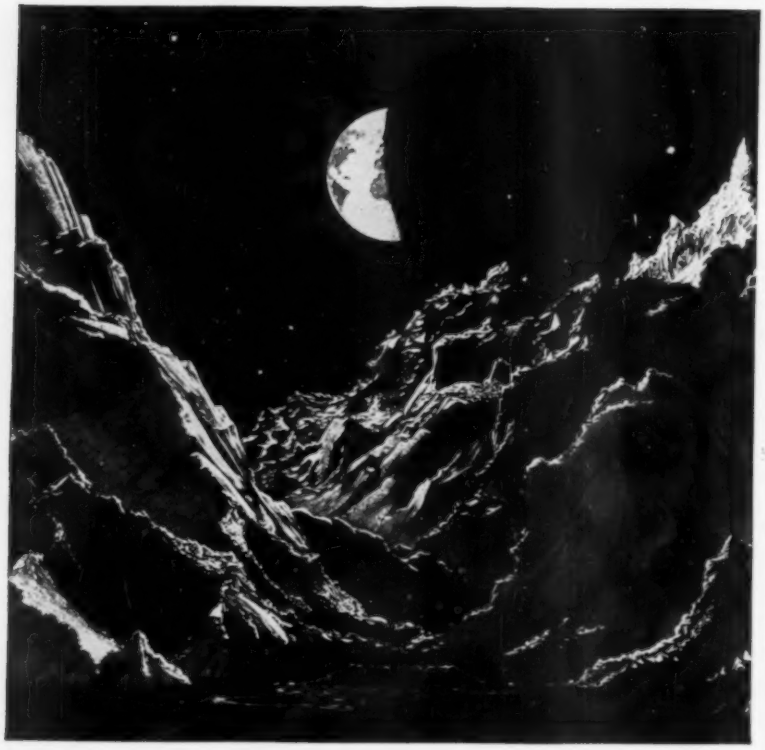

AN UP-TO-EARTH VIEW OF THE FUTURE IN SERVO CONTROLS AND INSTRUMENTATION

The Martin launching vehicle of the first man-made Earth satellite will be the opening gun of a new and endless age of exploration into space.

There are many exciting new opportunities at Martin in the fields of servo controls development and instrumentation engineering.

If you are doing some down-to-earth thinking on this fabulous future you'd do well to contact J. M. Hollyday, Dept. A-12, The Glenn L. Martin Company, Baltimore 3, Maryland.

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(A) DIGITAL COMPUTER ENGINEERS for application of transistorized digital computers to Fire Control, Navigation and Missile Guidance Systems. Openings in Computer Applications, Logical Design, Dynamic Analysis, Circuit Development, Component Development, Packaging Design and Field Evaluation.

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(D) DATA REDUCTION & ANALYSIS ENGINEERS. Experience required: General planning for Data Processing, including estimating and scheduling; specification of data transcription equipment and techniques; preparation of computational requirements, procedures, and knowledge of machine programming; mathematical studies, equation formulation, digital smoothing and filtering techniques; data reduction equipment, functional design and project engineering.

(E) MISSILE GUIDANCE SYSTEMS ENGINEERS to work in the areas of System Synthesis (mathematical & functional); System Analysis and Evaluation (dynamic & error); System Instrumentation, System Integration (electrical & mechanical compatibility); System In-Plant Test. Degree in E.E., Physics or Mathematics necessary, with active participation in any of the following fields: Advanced mathematics; guidance and control systems; statistical error analysis; inertial navigation systems; stable platform; analog or digital computing systems; optical systems.

(F) ELECTRONIC SYSTEMS. Advanced systems analysis and research in the fields of: Radar, Counter-measures, Guidance, Navigation, Communication, Propagation. B.S., M.S., or Ph.D., with heavy experience in military airborne and ground systems.

Fill out and mail the coupon to indicate your interest in any of these jobs. Or, simply check the second box if you would like to receive a free copy of "AN ANSWER RE: GUIDANCE," containing five technical papers discussing important questions relating to Inertial Navigation.

ARMA

Division American Bosch Arma Corp.
Roosevelt Field, Garden City, L.I., N.Y.
Technical Employment Dept. 12-674

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( ) Please send me additional information concerning the job coded.....

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This is Litchfield Park, Arizona. Located 18 miles west of Phoenix, this ideal "vocationland" is a modern monument to the growth of Goodyear Aircraft. And a major factor in this continued growth and diversification is the freedom of creative thought and expression enjoyed by Goodyear Aircraft engineers.

Here, engineers know that *every* idea has a chance. And in transforming their ideas into realities, Goodyear Aircraft engineers find the stimulation of creative challenge and the satisfaction of realistic accomplishment.

If *you* are a creative engineer with faith in your ideas and confidence in your ability to make them work, here's your opportunity to become a part of this great creative team. For, because of our continued growth, we must expand our engineering staffs at both Litchfield Park and Akron, Ohio.

Assignments on a variety of highly significant projects are available to engineers in all specialties. The most modern equipment and facilities, including one of the largest computer laboratories in the world, permit application of the most advanced technology.

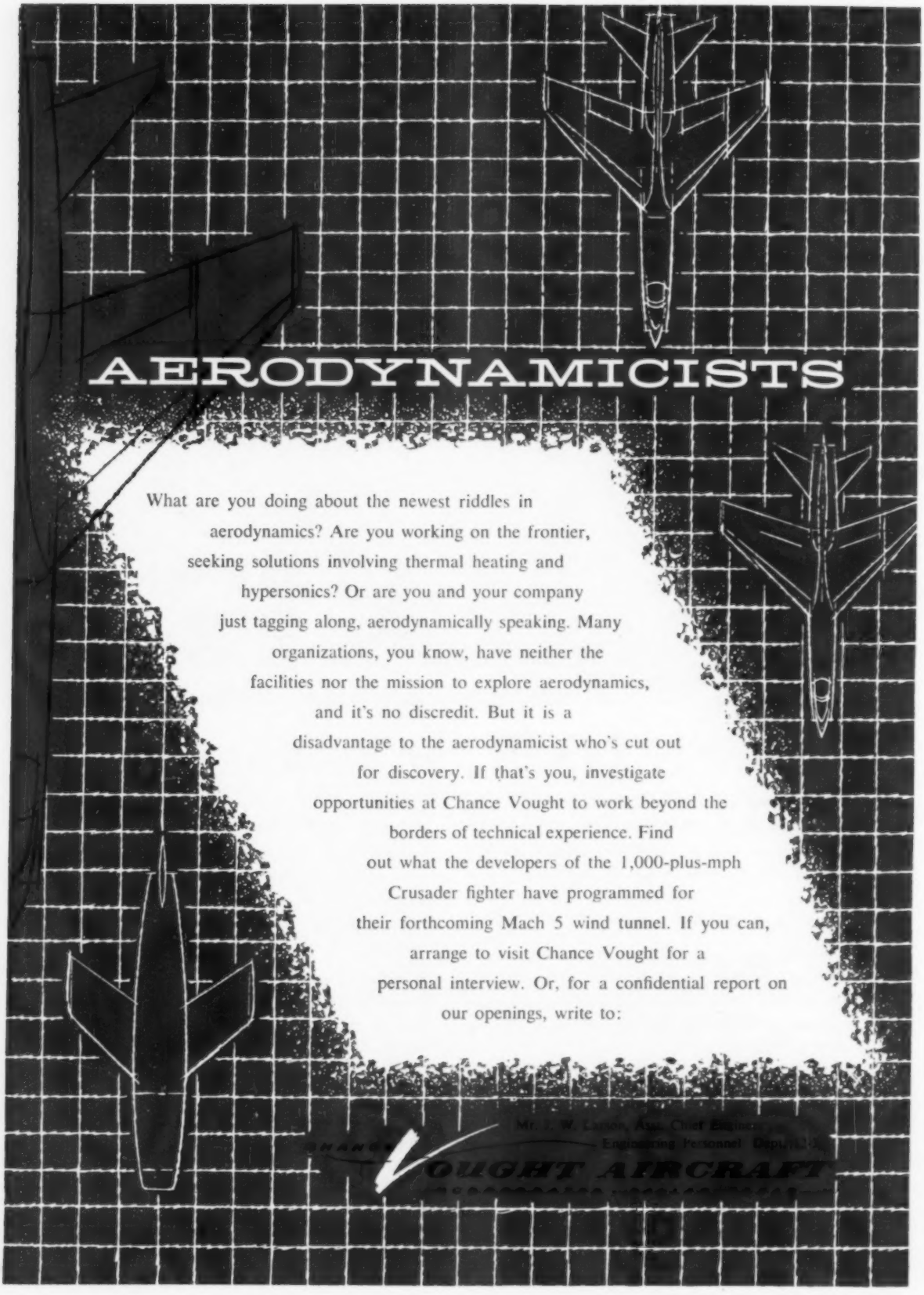
Salaries and benefits are, of course, liberal. And for those who wish to continue with academic studies, company-paid tuition courses leading to advanced degrees have been established at nearby colleges.

For further information on *your* career opportunities at Goodyear Aircraft, write: Mr. C. G. Jones, Personnel Department, Goodyear Aircraft Corporation, Akron 15, Ohio.

They're doing big things at

GOODYEAR AIRCRAFT

THE TEAM TO TEAM WITH in AERONAUTICS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What are you doing about the newest riddles in aerodynamics? Are you working on the frontier, seeking solutions involving thermal heating and hypersonics? Or are you and your company just tagging along, aerodynamically speaking. Many organizations, you know, have neither the facilities nor the mission to explore aerodynamics, and it's no discredit. But it is a disadvantage to the aerodynamicist who's cut out for discovery. If that's you, investigate opportunities at Chance Vought to work beyond the borders of technical experience. Find out what the developers of the 1,000-plus-mph Crusader fighter have programmed for their forthcoming Mach 5 wind tunnel. If you can, arrange to visit Chance Vought for a personal interview. Or, for a confidential report on our openings, write to:
Engineering Personnel Dept.
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An AC* ENGINEER TELLS HIS STORY

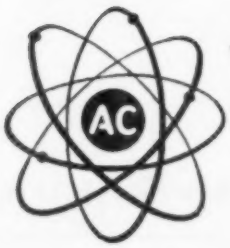
Working at AC, THE ELECTRONICS DIVISION OF GENERAL MOTORS is exciting . . . challenges every inch of my engineering ingenuity, currently I am working on a phase of the Inertial Guidance System Program. A month or two ago I was equally absorbed in our Jet Engine Fuel Control Program. I am certainly growing ENGINEERING "KNOW-HOW-WISE" and my salary checks reflect it. I started at a good salary . . . have had regular increases in salary and position . . . gosh, I like it here.

AND, I enjoy AC's *MASTER'S DEGREE PROGRAM,* University of Wisconsin—Milwaukee. I attend evening classes and AC is paying my tuition *and* with no strings attached.

My family enjoys Milwaukee too. Here in cool, southern Wisconsin we have endless miles of swimming beaches, parks, playgrounds that are ours for the asking. We have the cultural and shopping advantages of the big city in a community long known for its small town hospitality.

P.S. AC's Permanent Expanding Electronic Program provides openings for more Mechanical, Electrical Engineers and Engineering Technicians. Even "square pegs" are provided "square holes" at AC.

Write today in strictest confidence to my friend, Mr. J. F. Heffinger, Supervisor of Salaried Personnel.



*AC THE ELECTRONICS DIVISION

GENERAL MOTORS CORPORATION

Milwaukee 2, Wisconsin • Flint 2, Michigan

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ROYAL AIRCRAFT,
PRODUCERS OF
AMERICA'S ONLY ALL NEW
FIVE-PLACE TWIN ENGINE
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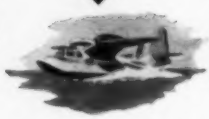

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Extensive expansion program makes it necessary for us to add two high caliber sales executives to our staff.

• VICE PRESIDENT — SALES

Top-Level management background necessary to organize and direct extensive sales program. Aircraft background preferred.

• REGIONAL SALES MANAGER

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If you can meet these requirements and are interested in a real challenge, send your resume and a recent photo to

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PILOT *with*
flight safety background

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RESPONSIBILITIES:

Coordinate all flight safety matters in major Engineering Flight Test organization — flight restrictions and limitations, select and test pilots' safety equipment, review new models from pilot escape and safety angle.

Maintain pilot safety program abreast of developments in the industry.

Organize flight safety material for incorporation in pilots' handbooks.

Conduct initial tests of new safety equipment for new model aircraft.

WRITE: Mr. J. H. Papin, Engineering Personnel Dept. AW,

NORTH AMERICAN AVIATION, INC.
Columbus, Ohio

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AIRCRAFT CONTROLS FIELD SOUTHERN CALIFORNIA LOCATION

We are a large eastern concern, who have recently opened a plant in the Los Angeles area, to do Hydraulic & Electromechanical product development. Currently there are 5 engineers in that organization. Our immediate objective is to locate 3 creative project engineers to round out a staff upon which we can base a sound growth program.

The engineers we are looking for should be theoretically well founded, be conversant with hydraulic servo design and be interested in product development. The man who can put his own ideas down on paper and then see his product right through to the production prototype stage, will advance rapidly.

We offer the flexibility of a small company, plus the fringe benefits and security of a well financed large corporation.

Please send complete resume with information about salary requirements to:

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ENGINEER, AE ME

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It is a truism that history is only made by history-makers. No one will dispute the truth of this when it comes to General Electric's pioneering work in applying nuclear energy to aircraft propulsion. Many specialized and highly qualified talents are engaged in this vital area.

The position now open offers many opportunities for professional achievement and unique engineering experience. It involves the preliminary design of major aircraft structures and the coordination of structural design with power plant design requirements. 4 to 6 years experience in aircraft design and development required.

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L. A. Munther
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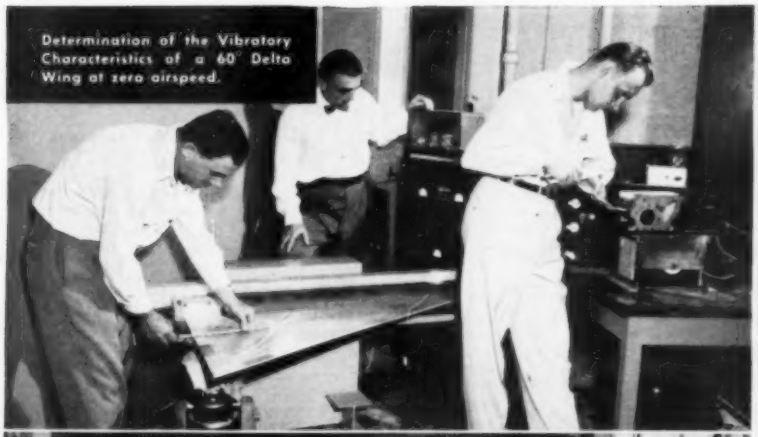
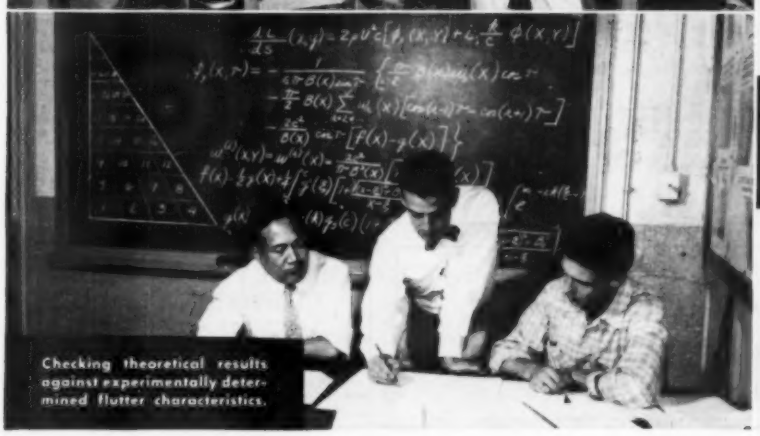
Idaho Falls, Idaho

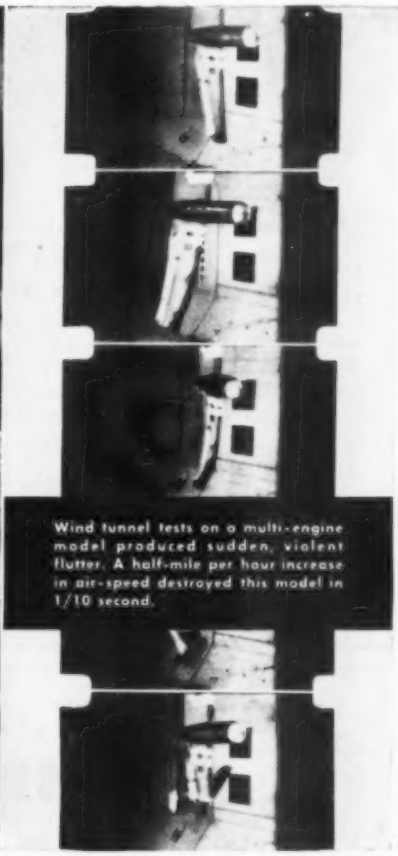
GENERAL ELECTRIC



Determination of the Vibratory Characteristics of a 60° Delta Wing at zero airspeed.



Checking theoretical results against experimentally determined flutter characteristics.



Wind tunnel tests on a multi-engine model produced sudden, violent flutter. A half-mile per hour increase in air-speed destroyed this model in 1/10 second.

AEROELASTICITY

AT CORNELL AERONAUTICAL LABORATORY

Our aeroelastic program is currently concerned with the transonic flutter of low aspect ratio wings, stall flutter of supersonic propellers operating at high angles of attack, and the dynamics of helicopter rotor blades. This program is a continuation of more than ten years of creative research effort in the field of aeroelasticity. New facilities will permit the extension of experimentation into the high temperature, high supersonic field.

The aeroelastic program is one of the many technical research programs currently in progress at C. A. L. We are now working on 160 different projects dealing with almost every area of research related to the challenging problems of modern flight. Electronics, materials, atmospheric physics, weapon systems, and applied mathematics are among the many stimulating areas of research available at C. A. L. for the professional man with an inquiring mind.

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P-3753, Aviation Week,
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Received by Dec. 27 will appear in the Jan. 7 issue subject to limitations of space available.

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AVIATION WEEK

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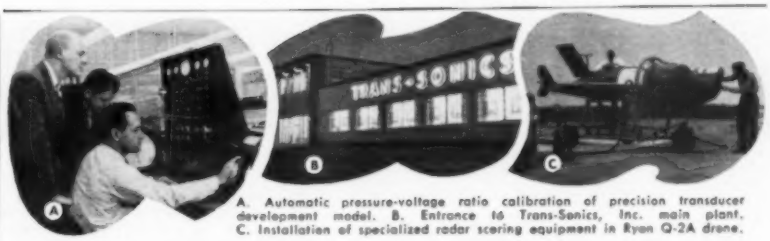

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P-3693, Aviation Week
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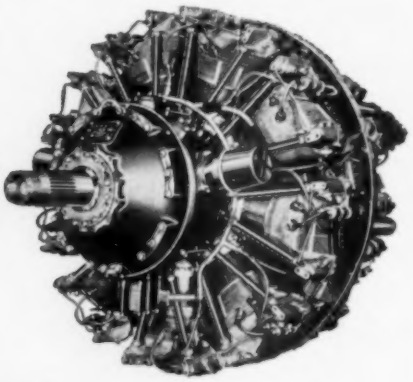

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DC-3

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Available for early Spring 1957 delivery—this DC-3 is one of the most completely equipped and best maintained private planes in service today.

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AIRCRAFT EQUIPMENT: **(1)** Goodyear single disc wheels and brakes including super DC-3 Axles; **(2)** S-200 Janitrol heater and ground blower (rate output 200,000 BTU); **(3)** Metropolitan air stair door and large baggage compartment door; **(4)** Fuel dump chutes; **(5)** Rudder servo tab modified for 1350 take-off H.P.; **(6)** Ring cowls modified for R-1830-94 engines; **(7)** Right and left manual shutoff valves in nacelles; **(8)** Flasher beacon installed; **(9)** Bendix direct cranking starters (type 36E00); **(10)** P-2 General Electric 200 amp generators; **(11)** Prop. alcohol supply tank 25 U.S. gallons; **(12)** Right and left fire detection system (Edison); **(13)** Right and left engine completely aeroquipped; **(14)** Right and left fuel flow transmitters; **(15)** Flares.

2000-HOUR AIRFRAME INSPECTION

In the 2000-hour airframe inspection made 800 hours ago (April 22, 1955), the following work was done by Aero Trades, Inc.:

Removed left and right outer wing panels, outer wing attach angles and doublers inspected in accordance with part A, paragraphs 1, 2, and 3 of airworthiness directive 39-24-1.

Part C heavy doubler installation previously complied with. Part 1, paragraph A, accomplished in accordance with Douglas Dwg. 5406787 (Installation of Witness Holes) and the skin was found to be free of cracks in center section.

Outer wing and center section cleaned, inspected and repaired as necessary. All four fuel tanks removed for inspection, right and left rear tanks reskinned with .051 material instead of .040.

Landing gear and tail wheel assemblies removed for complete overhaul and magnaflux.

Complete hydraulic system and units overhauled and converted to dual hydraulic pump operation.

The following records are current as of Nov. 30, 1956

TYPE	DC-3
C.A.A. Reg. No.	N28C
Mfg. Serial No.	7394
Date of Mfg.	7/3/42
Total Airframe Time:	21,000
Time Since 8000-Hour:	2,800
(Grand Central Aircraft Co., Dec. 1950)	
Time Since 2000-Hour:	800
(Aero Trades, April 1955)	
Engine: R-1830-94 (Steward Davis)	
Right Engine Serial No.	139553
Right Engine Total Time:	996:00
Right Engine Time Since Overhaul:	310:00
Engine: R-1830-94 (Engine Works)	
Left Engine Serial No.	P-146166
Left Engine Total Time:	227:00
Left Engine Time Since Overhaul:	215:00
Propeller: 23E50-473-6565A-18 (Babb Co.)	
Right Prop. Serial No.	P33415
Right Prop. Total Time:	1568:00
Right Prop. Time Since Overhaul:	310:00
Propeller: 23E50-473-6565A-18 (Babb Co.)	
Left Prop. Serial No.	NK70612
Left Prop. Total Time:	1568:00
Left Prop. Time Since Overhaul:	310:00

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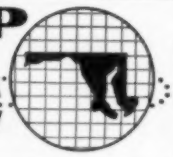

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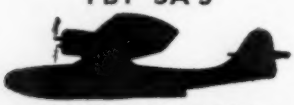

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LETTERS

Limit to Spending

Why do you have to be so intemperate in your editorials? I usually agree with them, but as an economist I must protest against your sometimes determined efforts to close your eyes to any legitimate point of view opposed to yours.

Concluding your last editorial (AW Dec. 3, p. 21), which I thought was generally excellent, you say:

"We earnestly hope that the military policy and budget debate for Fiscal 1958 will be conducted with genuine realization of the defense needs of this country and its allies for survival rather than as a routine bureaucratic budget exercise whose only goal is a tidy fiscal accounting."

Now this is grossly unfair in implication. There is and has to be a limit to defense expenditures somewhere, just as to everything else. Some people put them lower than others, that's all. But I assure you, most of them are thinking in terms of the overall good of the country. And for that matter, there probably are proportionately almost as many bureaucrats in our own industry as in the government.

I think it does our cause harm to affect to regard everyone who wants to spend less on defense than the most liberal-minded character as somehow little and petty. I think real statesmanship calls for a broader point of view.

STEPHEN B. MILES, JR.
California Div., Lockheed Aircraft Corp.

Exception Noted

In your issue of October 22, page 68, there is an article entitled "Nike Powerplant Details Revealed" to which the principal engineers in our Liquid Rocket Division take exception on a factual basis.

While it is not quite clear from the article whether it is merely a report of a paper read at the American Rocket Society's recent Buffalo Meeting or whether some of the statements are those of the AVIATION WEEK writer, the general impression leaves Aerojet-General in an apparently unnecessary unfavorable light.

The statement to which our people take principal objection is in the second paragraph which states that "Bell (Aircraft) currently is the only source which satisfies the revised Nike specifications." The actual record is as follows:

A. Aerojet-General is at this time fabricating, testing and delivering thrust chambers for use on the Nike missile which meet the latest requirements of the program; this includes weight, performance, durability, reliability, etc.

B. We are continuing to produce chambers at the same rate as in the past and have to date supplied approximately 70% of all thrust chambers for Nike.

C. For the past ten years we have been part of the Nike program as contractor to Douglas, Western-Electric and Army Ordnance. During this time there has been a progressive change in missile requirements which has been met by improved AGC product. Over this period several major design evolutions have been made, each of which has been qualification tested and placed into quantity production.

D. The present AGC design is considered to achieve an optimum balance of high reliability, low weight, efficient performance and low manufacturing cost.

I know that because of the prestige AVIATION WEEK enjoys, and your personal devotion to stating the facts as accurately as human frailty permits, you will welcome this comment. . . . I assure you there is no intent to be critical.

GEORGE E. PELLETIER
Director of Public Relations
Aerojet-General Corp.
Azusa, Calif.

(Further research by AVIATION WEEK confirms that Aerojet is also meeting the latest Army specifications for Nike boosters including -50F starting capacity.—ED.)

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

$500,000, Not $50,000

On page 104 of your December 3rd AVIATION WEEK issue wherein under "Expansions, . . .", you indicated Aircraft Radio Corporation has opened its new $50,000 engineering laboratory. This should be $500,000.

A. W. PARKES, JR.
Vice President
Aircraft Radio Corporation
Boonton, New Jersey

Copilot vs. Engineer

I have been following the series of letters you have printed in answer to the letter from United's co-pilot/flight engineer/jack of all trades, with considerable interest and a feeling of wonder that no one has pointed out the most important and obvious flaws in the position of ALPA on this matter.

Several years ago, co-pilot trainees required from 400 to 1,200 hours of multi-engine experience. Today any 21-year-old male who can pass a first class physical and get a commercial pilot's license with 165 hr. of Piper Cub and/or P-51 (Parker 51) time is good co-pilot material, even though his total experience in aviation may cover only two or three months. Accelerated training, check rides and emergency procedure drills can never replace the instinctive and split second comprehension and decisions required in an emergency situation. The only way this knowledge and judgment can be acquired is through years and hundreds of hours of experience. It takes two or three years to even begin to comprehend the complexity of the average routine flight, to say nothing of the non-routine flights that occasionally make headlines.

The ALPA is well aware of this fact and therefore hopes to flight condition the future co-pilots by allowing them to usurp the flight engineer's job for a year or two before they can move up to the co-pilot's job. What the ALPA fails to, or refuses to, recognize is that they cannot hope to raise their pay while lowering their standards for acceptance into the profession. Airline piloting is undoubtedly the most underpaid profession in the transportation industry, but the airlines will never pay more money for less qualified pilots. The standards must be raised before the pay can be raised.

The threat of pilot lay-offs due to jet equipment is an empty threat at best. Several "thinking" captains have told me that unless the flight time limitations on jets is changed from hours per day, week, month and year to a mileage limitation (25,000 miles per month is the average figure given), there will be sufficient openings created at the top of the list to protect the men on the bottom of the list. Flying 20 or 25 days per month does not particularly appeal to most of the senior captains who could earn as much or more at some less tiring job. The lie of jet aircraft simplicity is based on the false premise that simplifying the theory of thrust development simplifies the aircraft as a whole, while ignoring the greater complexity of the accessory and utility systems required to adapt the jet engine to a workable aircraft. The complexity of the jet aircraft will require better trained and qualified flight engineers with a broader understanding of the basic workings of the various units in each system and this understanding can only be gained by working with and on these units. The skilled A&E mechanic constitutes the only source of future flight engineer material consistent with safety.

Jet aircraft will not minimize the job of any crew member but rather will magnify the importance and skills incident to each crew member's job. The unprecedented fuel consumption rate of jet aircraft will eliminate holding time forever and will require earlier and more critical decisions concerning alternate destinations. It will force upon the airline industry a revolution in thinking of greater magnitude than the changes brought about by the increased speed and the increased investment per aircraft. Jet aircraft can either make or break an airline, depending on the solution of many problems that are not known or understood at this time. If the captain is to continue as the commander of his aircraft, more and more of his routine work must be delegated to the subordinate crew members to allow him sufficient time to reach the decisions required of him.

Now is the time for ALPA to look ahead and come up with some important ideas for furthering the interests of the industry as a whole, because if ALPA misses this golden opportunity it may be the last chance they have to aid or influence the industry in any important way.

H. M. LEDET, Flight Engineer
Bellmore, New York

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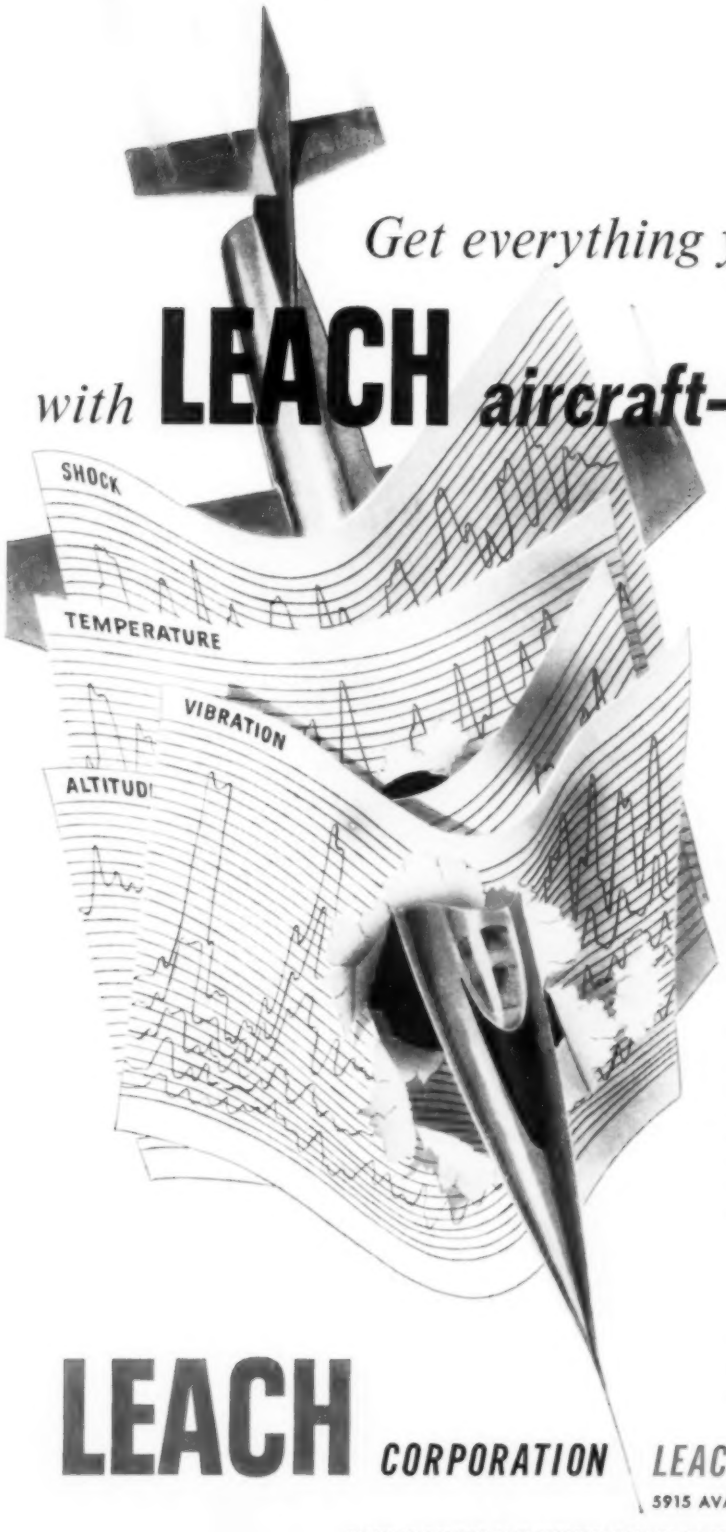

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